

**ADJUSTMENT TO EXERCISE LAPSES: RELATIONSHIPS BETWEEN PROBLEM-
SOLVING AND SOCIAL COGNITIONS ABOUT ADHERENCE**

A Thesis Submitted to the College of
Graduate Studies and Research
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy
in the College of Kinesiology
University of Saskatchewan
Saskatoon

By

PARMINDER KAUR FLORA

PERMISSION TO USE

In presenting this dissertation in partial fulfilment of the requirements for a Postgraduate degree from the University of Saskatchewan, I agree that the Libraries of this University may make it freely available for inspection. I further agree that permission for copying of this dissertation in any manner, in whole or in part, for scholarly purposes may be granted by the professor who supervised my dissertation work or, in their absence, by the Dean of the College in which my dissertation work was done. It is understood that any copying or publication or use of this dissertation or parts thereof for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and to the University of Saskatchewan in any scholarly use which may be made of any material in my dissertation.

Requests for permission to copy or to make other use of material in this dissertation in whole or part should be addressed to:

Dean of the College of Kinesiology
University of Saskatchewan
Saskatoon, Saskatchewan
S7N 5B2

Abstract

Regular exercise is challenging and lapses in activity may lead to non-adherence. Adherence may be particularly challenging for symptomatic individuals with disease-related symptoms that may impede exercise. The combined use of cognitive-behavioural strategies including problem-solving has been strongly encouraged for promoting exercise adherence. However, evidence supporting the link between the use of the independent strategy of problem-solving and exercise adherence is limited. The overall purpose of this dissertation was to examine problem-solving relative to exercise-lapse related problems. Using two theoretical frameworks that offer insight into problem-solving (Model of Social Problem-Solving and Social Cognitive Theory), three studies were conducted to examine proposed relationships in various asymptomatic and symptomatic exercising samples. In Study 1A, relationships between self-regulatory efficacy (SRE) for exercise and problem-solving approach (task-diagnostic and self-diagnostic) were explored in a sample of exercising university students ($n = 79$). Results indicated that SRE beliefs were significantly and (1) positively related to task-diagnostic problem-solving approach and (2) negatively related to self-diagnostic problem-solving approach. In Study 1B, relationships between problem-solving effectiveness and exercise-related social cognitions were examined in the same sample. Findings demonstrated that problem-solving effectiveness was positively associated with social cognitive correlates of exercise adherence linked to adaptation. Relationships demonstrated in Study 1 provide preliminary support for previously unexamined problem-solving research questions relative to exercise. In Study 2, relationships between problem-solving effectiveness and exercise-related social cognitions (self-efficacy and persistence) were examined in a sample of exercising cardiac rehabilitation initiates ($n = 52$). These relationships were considered relative to two distinct components of the problem-solving

process (seeking solutions to problems and carrying out solutions), which have not previously been examined relative to exercise lapses. Findings indicated significant relationships between problem-solving effectiveness and (a) self-efficacy for problem-solving (seeking solutions to problems), (b) persistence with problem-solving, (c) self-efficacy for solution implementation (carrying out solutions) and (d) persistence with solution implementation. In Study 3, problem-solving was examined among exercising cancer survivors ($n = 35$) with cancer-related fatigue, a problematic exercise barrier. Partial support was demonstrated for differences between more and less effective problem-solvers on fatigue-related variables. An under-examined area in problem-solving research was also examined in this study; the relationship between problem-solving and positive psychological functioning. Findings indicated significant differences for positive psychological functioning between individuals with higher and lower positive problem orientation. Taken together, the three studies represent an initial attempt to advance exercise and problem-solving literature by illustrating important theoretical relationships in three samples of exercisers, and addressing important gaps in the exercise and problem-solving literature. In regard to the latter point, the research was the first to examine (a) variables that may link problem-solving to exercise adherence, (b) two distinct components of the problem-solving process relative to an exercise lapse situation, and (c) potential links between problem-solving and selected positive psychological outcomes. Future research directions relative to problem-solving and exercise are suggested as possible next steps to advance this preliminary research.

Acknowledgements

I have been very fortunate to have support and guidance from many special people who believed in me and helped me complete my dissertation and my degree.

First and foremost to my mentor and friend, Dr. Larry Brawley. I am fortunate and truly honoured to have spent these years working with you. You really do pour your heart and soul into your students. Your endless energy and devotion to supporting and guiding your students has been pivotal to my development as a researcher and will resonate with me for years to come. Thank you for always believing in me and bringing out the best in me. Your ongoing desire to learn *with* your students is admirable and inspiring. I am deeply indebted to you for being as awesome as you are, and for making my Ph.D. a fun learning experience. Sincerely, thank you.

To my committee members, Drs. Larry Brawley, Nancy Gyurcsik, Kevin Spink, Laurie Hellsten, and Tim Elliott, thank you for your time and thoughtful feedback on my project. Through interacting with all of you, I learned to be a more careful, critical, and thoughtful researcher.

A special thank you to my mom and dad for always being by my side to guide me or just listen. I appreciate all of the sacrifices that you have made and the love that you have poured into me to get me to this place in my life. You are both my angels. To my sisters Parmjit and Gurjit, and my wonderful extended family who is too large to name here, thank you for the endless support you give me, and the open arms you receive me with each time I return home. I am grateful for two special family members who we lost during my Ph.D., Surjit Singh Flora and Ramesh Bhandari, who always encouraged me to pursue higher education and dream big.

To my dearest friends and fellow moustache mafia members and associates, I am blessed to have so many wonderful people in my life who have encouraged and supported me, and also pulled me away from my work when it was best for me. While I cannot name all those who have made my Ph.D. years a blast, I would like to make special mention of Leah, Aman, Ananya, Candace, Karen, Jesse, Lenka, Sunny, Gagan, Ravi, Miranda, Parmjit, Tanisha, Sukhjit, and my dad. All of you filled my heart and inspired and uplifted me in various ways. Thank you for the laughs and a ton of great memories! Thanks to all the people who made my experience in Saskatoon special and memorable, including the wonderful families in the Saskatoon Sikh sangat who took me in as their own, Ravinder & Tejinder Grewal, Harpreet & Pritam Grover, Goitom & Fiore Kahsai, Sarabjeet & Baljit Singh, Leah & Braden Ferguson and their families, and the U of S Huskies Wrestling family.

Special thanks to the Saskatoon Health Region, Regina Qu'Appelle Health Region, and Culos-Reed Health and Wellness Lab at University of Calgary for assisting with this research, and to the Social Sciences and Humanities Research Council of Canada for funding support. A big thank you to all the participants, without whom, this research would not have been possible.

The biggest thanks to Waheguru. Tera shukar hai!

Dedication

To my dad, my best friend, for always being by my side.

Table of Contents

PERMISSION TO USE	i
ABSTRACT	ii
ACKNOWLEDGEMENTS	iv
DEDICATION	v
LIST OF APPENDICES	x
LIST OF FIGURES	xi
LIST OF TABLES	xii
LIST OF ABBREVIATIONS	xiii
 GENERAL INTRODUCTION.....	 1
Issues of Adherence to Physical Activity	1
Exercise and Management of Chronic Diseases	2
Lapses, Relapse Prevention, and Exercise Adherence.....	2
Self-Management	3
Adjustment	4
Problem-Solving Research.....	11
Problem-Solving in Physical Activity	13
 STUDY 1A: EXAMINING THE RELATIONSHIP BETWEEN SELF-REGULATORY EFFICACY AND PROBLEM-SOLVING APPROACH	 16
INTRODUCTION	16
Self-Efficacy, Problem-Solving, and Exercise Adherence	16
Purpose and Hypotheses	17
METHOD	18
Participants and Design.....	18
Recruitment and Inclusion	18
Measures	19
Stimulus Material	22
Procedure	23
Analytic Plan.....	24
RESULTS	25
Data Management	25
Missing data.	25
Outliers.....	25
Testing of assumptions.	25
Descriptive Statistics.....	26
Demographic variables.	26
Descriptive data.	26
Self-regulatory efficacy and problem-solving approach.....	27
Social-cognitive theory-based relationships.	29
Problem check and message quality checks.	30
Post-hoc regressions examining social cognitions and exercise adherence.....	30
DISCUSSION	32

STUDY 1B: EXAMINING THE RELATIONSHIP BETWEEN PROBLEM-SOLVING EFFECTIVENESS AND EXERCISE OUTCOMES	34
INTRODUCTION	34
Purpose and Hypotheses	35
METHOD	36
Measure.....	36
Analytic Plan.....	37
RESULTS	37
Data Management	37
Missing data.	38
Testing of assumptions.	38
Descriptive Statistics.....	38
Descriptive data.	38
Problem-solving effectiveness and exercise social cognitions.	39
DISCUSSION.....	40
STUDY 1 GENERAL DISCUSSION	41
Strengths and Limitations	42
STUDY 2: ADJUSTMENT TO CARDIAC REHABILITATION EXERCISE LAPSES: EXAMINATION OF PROBLEM-SOLVING PROCESS	45
INTRODUCTION	45
Managing Cardiac Rehabilitation Exercise	45
Problem-Solving in Cardiac Rehabilitation	46
Self-Regulatory Efficacy, Persistence, and Problem-Solving	47
The Distinction Between Problem-Solving and Solution Implementation.....	48
Purposes of this Study.....	48
Relationships between adherence-related social cognitions.	49
Problem-solving predicting self-efficacy and persistence.	49
Differences in social cognitions as a function of PS effectiveness.....	49
Hypotheses	50
METHOD	51
Participants and Design.....	51
Recruitment and Inclusion	52
Measures	52
Stimulus Material.....	58
Procedure	59
Analytic Plan.....	60
RESULTS	61
Data Management	61
Missing data.	61
Outliers.....	61
Descriptive Statistics.....	62
Descriptive data.	62
Relationships between adherence-related social cognitions.	62
Problem-solving predicting self-efficacy and persistence.	63
Differences in social cognitions as a function of problem-solving effectiveness.....	63

Testing of assumptions.	63
Problem check and message quality checks.	65
Post hoc Analyses	65
DISCUSSION	68
Strengths and Limitations	71
Future Directions	73
 STUDY 3: EXAMINING THE RELATIONSHIP BETWEEN SOCIAL PROBLEM-SOLVING AND EXERCISE SOCIAL COGNITIONS AMONG ACTIVE CANCER SURVIVORS	75
INTRODUCTION	75
Exercise and Self-Management of Cancer-Related Fatigue	75
Research Needs in Problem-Solving	76
Social Cognitive Correlates of Exercise Behaviour and the Problem-Solving Process	77
Self-regulatory efficacy and persistence.	77
Decisional struggle.....	78
Perceived fatigue and fatigue acceptance.	78
Examining problem-solving and aspects of process.	79
Problem-Solving and Positive Psychological Functioning.....	80
Psychological well-being.	81
Rumination.....	82
Purposes of this Study.....	83
Identifying links between problem-solving and exercise social cognitions.	84
Identifying differences in positive psychological functioning as function of PS.	84
Hypotheses	85
METHOD	85
Participants and Design.....	85
Recruitment and Inclusion	86
Measures	87
Procedure	93
Analytic Plan.....	93
Problem-solving and exercise social cognitions.	93
Problem-solving and positive psychological functioning.	94
RESULTS	94
Data Management and Screening	94
Missing data.	94
Outliers.....	95
Testing of assumptions.	95
Descriptive Statistics.....	95
Demographic variables.	95
Descriptive data.	95
Problem-solving and exercise social cognitions.	96
Problem-solving and positive psychological functioning.	97
Post hoc Analyses	99
DISCUSSION	100
Differences as a Function of Problem-Solving Effectiveness	100
Exercise social cognitions.....	100

Positive psychological functioning.	102
Exploring other theory-based relationships.	104
Strengths and Limitations	105
GENERAL DISCUSSION	106
Contribution to Research on Exercise Interventions	110
Research Gaps and Recommendations Addressed	111
Addressing disease-specific research needs.....	111
Positive psychological functioning.	111
Limitations	112
Design and sample size.	112
Measurement.....	112
Generalizability.....	112
Strengths	113
Future Directions	114
REFERENCES	116
APPENDICES	130

List of Appendices

Appendix A: Ethics approval for Study 1	130
Appendix B: All measures for Study 1	131
Appendix C: Stimulus material for Study 1.....	137
Appendix D: Correlations between main study variables for Study 1.....	138
Appendix E: Ethics approval for Study 2	139
Appendix F: All measures for Study 2	140
Appendix G: Stimulus material for Study 2	150
Appendix H: Correlations between main study variables for Study 2.....	151
Appendix I: Ethics approval for Study 3	152
Appendix J: All measures for Study 3	154
Appendix K: Correlations between main study variables for Study 3.....	165

List of Figures

Figure 1: Schematic representation of the five-dimension model of social problem-solving	9
--	---

List of Tables

Table 1: Means for All Study Variables	27
Table 2: Predictors of Task-Diagnostic Problem-Solving Approach	28
Table 3: Predictors of Self-Diagnostic Problem-Solving Approach.....	29
Table 4: Social Cognitive Theory-Based Relationships	30
Table 5: SRE and Problem-Solving Approach	31
Table 6: Means for All Study Variables	39
Table 7: Means for All Study Variables Grouped by Problem-Solving Effectiveness	62
Table 8: Social Cognitive Theory-Based Relationships	64
Table 9: Social Problem-Solving Model-Based Relationships.....	65
Table 10a: Predictors of Anticipated Persistence with CR Exercise	67
Table 10b: Predictors of Anticipated Persistence with Problem-Solving.....	68
Table 10c: Predictors of Anticipated Persistence with Solution Implementation	68
Table 11: Fatigue-Related Variables and Exercise Social Cognitions	98
Table 12: Positive Psychological Function.....	98
Table 13: Predictors of Persistence	100
Table 14: Summary of Study Findings	109

List of Abbreviations

AS = avoidant style

CR = cardiac rehabilitation

HMR = hierarchical multiple regression

ICS = impulsive/careless style

MSPS = Model of Social Problem-Solving

NPO = negative problem orientation

PPF = positive psychological functioning

PPO = positive problem orientation

PS = problem-solving

PSE = problem-solving effectiveness

PST = problem-solving therapy

PWB = psychological well-being

RPS = rational problem-solving style

SCT = Social Cognitive Theory

SE = self-efficacy

SEPS = self-efficacy for problem-solving

SESI = self-efficacy for solution implementation

SI = solution implementation

SPSI-R = Social Problem-Solving Inventory-Revised

SRE = self-regulatory efficacy

Introduction

Issues of Adherence to Physical Activity

The health benefits obtained through regular physical activity participation are well-documented (Canadian Journal of Public Health, 2007). The latest Canadian Physical Activity Guidelines released by the Canadian Society for Exercise Physiology recommend that adults and older adults should accumulate at least 150 minutes of moderate to vigorous intensity aerobic physical activity per week in bouts of 10 minutes or more (CSEP, 2012). Yet statistics indicate that nearly half of Canadians are considered inactive (Statistics Canada, 2006).

Canadians are undoubtedly aware of the numerous health benefits associated with physical activity and exercise, yet despite this, fail to meet guidelines. The high prevalence of inactivity in Canada has been linked to degenerative conditions and even premature death. Katzmarzyk, Gledhill, and Shephard (2000) have also noted the burden of sedentary living on the health care system and the economy. However, despite the negative consequences that stem from physical inactivity, these seem to fail to motivate Canadians to take action. Exercise and health psychologists have examined this dilemma. While there may be many explanations for the high prevalence of inactivity, one perspective is that individuals may lack the necessary self-regulatory strategies required to regularly perform exercise. Without the necessary self-regulatory skills, individuals' likelihood of performing health behaviours such as exercise at the level recommended by public health advocates is compromised. Among asymptomatic or healthy individuals, the performance of regular exercise can be impeded by numerous challenges and setbacks, and these may be further compounded within symptomatic samples where disease-related symptoms can interfere with exercise and may be difficult to overcome.

Exercise and Management of Chronic Diseases

Regular exercise is an important component of managing many chronic diseases (e.g., arthritis, cardiovascular disease, diabetes). Exercise for disease-management must focus on individuals self-managing their health and physical condition over the lifetime, rather than depending on a cure (Bandura, 1997). Therefore, the development of self-regulatory skills may be especially important among these people (i.e., Rejeski, Brawley & Jung, 2008).

Lapses, Relapse Prevention, and Exercise Adherence

Despite individuals' desire to be regularly active, periodic lapses, or temporarily missing activity may be inevitable (Lox, Martin Ginis & Petruzzello, 2006). Brownell and his colleagues describe a *lapse* as a slight error or slip that results in the re-emergence of a previous habit which may lead to the state of relapse. Corrective action can be taken to manage a lapse, as control is not lost completely in this situation (Brownell, Marlatt, Lichtenstein & Wilson, 1986). An exercise lapse may occur when an individual temporarily misses planned exercise and returns to a previous state of inactivity. While an exercise lapse may not always lead to a state of relapse (i.e., completely sedentary behaviour), it is a problem that must be overcome in order to maintain regular activity. Therefore, examination of exercise lapses as problems requiring solution is an important area of research inquiry in the study of physical activity adherence. While it is not the theoretical focus of this dissertation, the relapse prevention model is one framework that addresses how an individual may cope with a lapse situation.

Marlatt and Gordon's (1985) elaboration of their relapse prevention model addresses the process of coping with a lapse and acknowledges the role of self-efficacy beliefs. According to their model, an individual's coping response to a high-risk situation can determine self-efficacy

beliefs and influence the likelihood of relapse. While relapse prevention may help anticipate and avoid maladaptive reactions to lapses through early identification of high-risk situations, problems cannot always be anticipated. Over the course of everyday living, individuals may experience unanticipated problems that demand a response for adaptive functioning, but for which effective responses may not be immediately apparent or available. In these situations individuals must attempt to identify effective solutions. Relative to both exercise and disease management, self-management skills for responding to unanticipated problem circumstances which require adaptation become important.

Self-Management

Self-management is a process that involves self-regulatory strategies and personal skills coupled with resources from healthcare professionals and supportive others to manage symptoms and improve function (Rejeski, Brawley & Jung, 2008). Personal efficacy beliefs are also important in the self-management model (cf. Bandura, 1997). A key feature of self-management programs is that individuals are taught to take greater initiative for their health care and dealings with health personnel to optimize health benefits (Bandura, 1997). Holman and Lorig (1992) offer a prototypic model for self-management of various chronic diseases, which is designed to teach pain control techniques, proximal goal-setting, problem-solving, and medication management (cf. Bandura, 1997). The effectiveness of a self-management approach to self-regulation has been examined and better self-management is associated with better outcomes (e.g., reduced pain, increased coping skills) and disease management (i.e., management of chronic pain in arthritis; Holman & Lorig, 1992; Osborne, Wilson, Lorig, & McColl, 2007).

Good adjustment may be a key component of self-management and successful adherence to health behaviours (Rejeski, Brawley & Jung, 2008). Several related literatures have addressed adjustment, describing components that are essential for psychological adjustment and behavioural effectiveness. Background on two perspectives on adjustment relative to physical activity adherence is instructive.

Adjustment

Self-efficacy and adjustment. Rooted in the framework of the agentic aspect of social cognitive theory, a sense of personal efficacy or control is essential for psychological adjustment and behavioural effectiveness (cf. Bandura, 1997; Maddux & Lewis, 1995). In their chapter on self-efficacy and adjustment, Maddux and Lewis (1995) outline the importance of self-efficacy beliefs in adjustment.

Self-regulation. Self-efficacy beliefs have been examined in physical activity and health promotion literature for their role in self-regulation. Self-regulation theories aim to understand how people resist temptations, persist with effort, and carefully weigh options in order to choose the optimal course of action to reach their goals. Bandura (1997) expands this view by indicating that self-efficacy beliefs facilitate self-regulation through their influence on goals, persistence, effort, and activity choice. Physical activity research has examined self-efficacy relative to self-regulation of exercise. A considerable portion of the literature on self-regulation has focused on the relation between self-regulatory efficacy beliefs and adherence. Use of the term “relation” here reflects the correlational nature of the majority of research linking self-regulatory efficacy to physical activity adherence (e.g., cardiac rehabilitation: See Woodgate & Brawley, 2008). A portion of this literature has also been concerned with experiments or

interventions designed to improve self-regulatory efficacy beliefs and related physical activity behaviours (i.e., Carlson et al., 2001; Rejeski et al., 2003), in both rehabilitating and chronic disease populations such as cardiac rehabilitation, arthritis and fibromyalgia (Culos-Reed & Gyurcsik, 1999; Woodgate & Brawley).

However, little of this exercise-related research has been concerned with problems that lead to lapses. Whereas the physical activity literature has documented barriers that lead to lapses and non-adherence, and investigated their relationship to self-regulatory efficacy beliefs (e.g., Gyurcsik et al., 2009), the examination of how individuals solve these problems has received little attention. Missing from this research is the study of how these efficacy beliefs relate to problem-solving problems and self-management of physical activity. To address this, the psychological adjustment literature focusing on health-related problems is informative.

Problem-solving and adjustment. According to Glasgow and his colleagues (2007) problem-solving ability is an important component of self-management. They note that "almost all models or conceptualizations of the core aspects of self-management support include problem-solving ability as a central feature" (Glasgow, Fisher, Skaff, Mullan & Toobert, 2007, p.33), and state that this is true of the widely adopted chronic disease self-management program of Lorig et al. (2001). Two key frameworks offer insight about problem-solving relative to adjustment. These frameworks are Social Cognitive Theory (Bandura, 1997) and the Model of Social Problem Solving (D'Zurilla, Nezu & Maydeu-Olivares, 2002). Some background on these perspectives is instructive relative to problem-solving and how they might be considered in physical activity research.

Social cognitive theory. The work of Bandura (1997) suggests that individual differences in problem-solving are observed as a function of the influence of self-efficacy beliefs on individuals' uses of cognitive resources. In a discussion about self-efficacy and adaptation and adjustment, Maddux and Lewis (1995) indicate that self-efficacy beliefs influence cognitive efficiency, where stronger self-efficacy beliefs are linked to greater cognitive efficiency. Maddux and Gosselin (2003) elaborate on this, indicating that when faced with complex decisions, individuals who have confidence in their ability to solve problems use their cognitive resources more effectively than do individuals who doubt their cognitive skills. In turn, this leads to better solutions and greater achievement. They state that in the face of difficulty, individuals with higher self-efficacy are more likely to remain *task-diagnostic* and continue to search for solutions to problems. By contrast, those with low self-efficacy are likely to become *self-diagnostic* and reflect on their inadequacies, which distracts them from their efforts to assess and solve problems (cf. Bandura, 1997). This contention has been supported in past research (i.e., Bandura & Wood, 1989; Wood & Bandura, 1989), but has not been examined relative to physical activity.

The relationship between problem-solving approach (task or self-diagnostic) and self-efficacy is an important consideration in the study of physical activity adherence. In a physical activity setting, individuals may experience problems that trigger a lapse in their regular activity (i.e., schedule change or conflict that interrupts activity plan). Using the agentic component of social-cognitive theory to forecast responses in this context, it is expected that individuals who have more confidence in their ability to solve problems would use their cognitive resources more effectively, remain task-diagnostic, and persist with their search for solutions (e.g., reschedule activity). In contrast, individuals with low self-efficacy for solving problems would use their

cognitive resources less effectively and become self-diagnostic. This self-focus could concern emotions linked to the problem as well as personal inadequacies believed to create the problem. A consequence of self-focused thoughts is distraction from seeking solutions (cf. Bandura, 1997). Relative to exercise adherence, self-regulatory efficacy beliefs are theorized to influence problem-solving approach, and the facilitation of solutions through greater cognitive efficiency, potentially resulting in reduced lapses, increased persistence, and better adherence.

Model of social problem solving. Within the problem-solving literature, the Model of Social Problem-Solving (MSPS) has been used to examine the role of problem-solving in adjustment. According to this framework, *problem-solving* is a self-directed, cognitive-behavioural process by which an individual seeks effective or adaptive solutions for problems encountered during everyday living. A *problem* is defined as any life situation or task (present or anticipated) that demands a response for adaptive functioning, but where no effective response is immediately apparent or available to the person due to the presence of one or more obstacles (D'Zurilla & Nezu, 2007). According to MSPS, two processes determine outcomes in the face of a problem: problem orientation and problem-solving style. *Problem orientation* reflects individuals' general awareness about problems, such as their tendency to either recognize or ignore problems, and their perception of problems, including general thoughts about problems and their ability to solve them. Problem orientation is characterized by two dimensions: positive problem orientation (PPO) and negative problem orientation (NPO). A positive problem orientation produces positive emotions and approach tendencies, sets the occasions for problem-solving behaviour, keeps attention focused on constructive problem-solving activities, and maximizes effort, persistence, and tolerance for frustration and uncertainty. PPO involves the general disposition of individuals to (a) appraise a problem as a "challenge" (i.e., opportunity for

benefit or gain), (b) believe that problems are solvable (optimism), (c) believe in their personal ability to solve problems successfully (problem-solving self-efficacy), (d) believe that successful problem solving takes time and effort, (e) commit themselves to solving problems with dispatch rather than avoiding them. Conversely, NPO generates negative emotions and avoidance tendencies, increases destructive worrying, and reduces effort, persistence and tolerance for frustration and uncertainty. NPO involves individuals' general tendency to (a) view a problem as a significant threat to well-being (psychological, social, economic), (b) doubt their personal ability to solve problems successfully (low problem-solving self-efficacy), (c) become easily frustrated and upset when confronted with problems (low frustration tolerance; D'Zurilla & Nezu, 2007).

Problem-solving style reflects the cognitive and behavioural activities by which individuals attempt to understand and find effective solutions to problems. It consists of three dimensions: rational problem-solving (RPS); impulsivity/carelessness style (ICS); and avoidance style (AS). RPS involves the rational, deliberate, systematic application of effective problem-solving skills. It involves four skills: (a) problem definition and formulation; (b) generation of alternative solutions; (c) decision making; and (d) solution implementation and verification. Each of these skills is a set of tasks with a unique purpose in the problem-solving process. ICS is characterized by active attempts to apply problem-solving strategies and techniques, albeit these attempts are narrow, impulsive, careless, hurried, and incomplete. AS is characterized by procrastination, passivity or inaction, and dependency (D'Zurilla & Nezu, 2007).

Each dimension within these two processes (problem orientation and problem-solving style) is classified as either constructive or dysfunctional. PPO and RPS are constructive, while

NPO, ICS, and AS are dysfunctional. According to MSPS, more effective problem-solvers, or individuals who score relatively high on constructive dimensions and relatively low on dysfunctional dimensions are likely to produce positive or adaptive outcomes, while less effective problem-solvers, or individuals who score relatively high on dysfunctional dimensions and relatively low on constructive dimensions are likely to produce negative or maladaptive outcomes (D'Zurilla & Nezu, 2007). A schematic representation of the model of social problem-solving is presented in Figure 1.

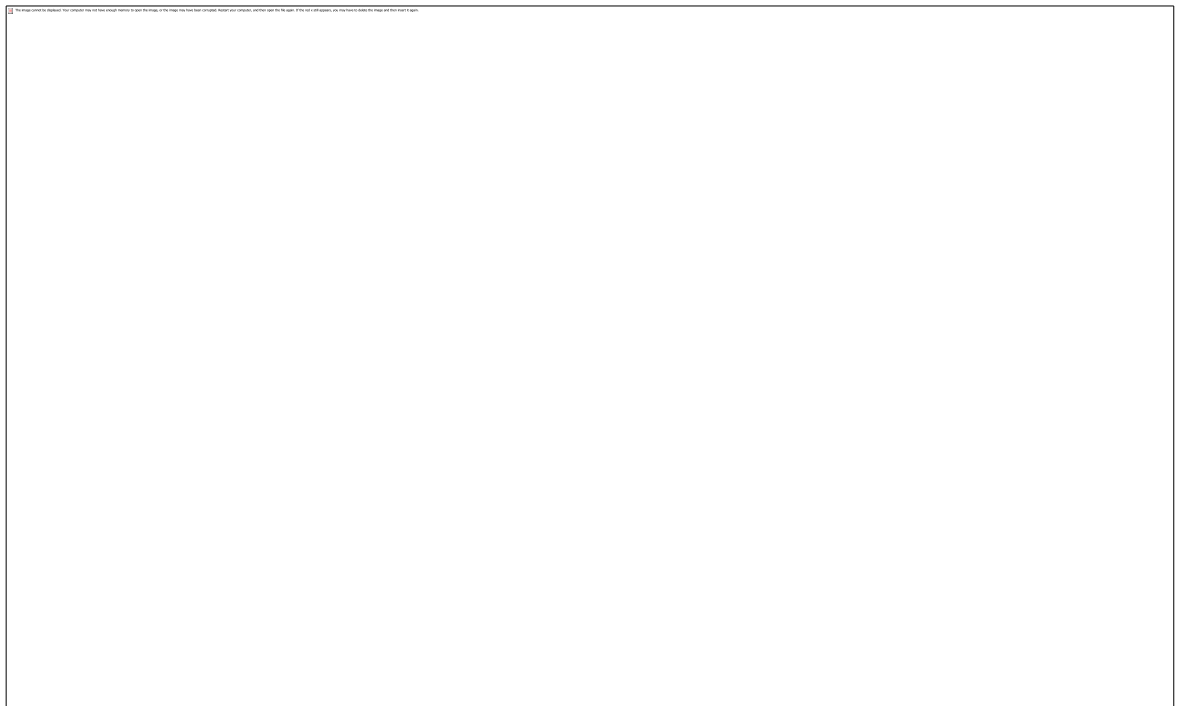


Figure 1: Schematic representation of the five-dimension model of social problem-solving. Reproduced from: D'Zurilla, T. J., & Nezu, A. M. (2007). *Problem-solving therapy: A positive approach to clinical intervention* (3rd ed.). New York: Springer Publishing Co.

Problem-solving training (PST) is a therapy program based on this model that has primarily been used in clinical settings. The objective of PST is to target and improve problem-

solving deficits identified within orientation and/or style processes in order to maximize effective problem-solving.

The MSPS may offer a useful perspective by which to examine physical activity adherence. The relationship between problem-solving and outcomes in the face of a problem can be examined relative to an exercise lapse. In the context of an exercise lapse, it would be expected that more effective problem-solvers would produce positive and adaptive outcomes (e.g., persist with finding solutions and resume activity despite the problem), as compared to their less effective counterparts who would produce negative or maladaptive outcomes (e.g., miss exercise because of the problem). As a result, more effective problem-solvers would better adhere to regular exercise as compared to less effective problem-solvers.

Complementary aspects of the models. Interestingly, both social cognitive theory and the model of social problem-solving frameworks highlight the role of cognitive components and behavioural strategies, offering complementary perspectives about problem-solving relative to adaptation and adjustment. Both frameworks indicate that adaptive problem-solving (e.g., task-diagnostic or constructive problem-solving) is positively related to self-efficacy beliefs and involves seeking and persisting with solutions to problems. Furthermore, maladaptive problem-solving (e.g. self-diagnostic or dysfunctional problem-solving) is associated with poor adjustment where an individual faces cognitive and behavioural inadequacies that impede solution resolution. Both models address the importance of problem-solving and self-efficacy beliefs for examining adjustment. However, more is known about the social cognitive theory correlates of physical activity in relation to adherence (see Culos-Reed & Gyurcsik, 1999; Woodgate & Brawley, 2008 for example reviews), although this research has not targeted

problem-solving, per se. As noted previously, conditions (e.g., barriers) that could be perceived as problems have been examined, but not from a task and self-diagnostic perspective. Little is known about problem-solving in relation to physical activity. This is surprising given the amount of research on problem-solving in general and in relation to health behavior specifically. A brief perspective on the research illustrates this.

Problem-Solving Research

Research examining relationships relative to problem-solving, as proposed by both the social cognitive theory and MSPS has been supportive of tenets of both frameworks (i.e., D'Zurilla & Nezu, 1999; Bandura & Wood, 1989; Wood & Bandura, 1989). MSPS-based relationships have been supported by experimental and correlational research with extant research primarily reporting that problem-solving ability is associated with a variety of adaptive and maladaptive reactions and consequences (D'Zurilla & Nezu, 1999). For example, adaptive functioning and well-being has been investigated relative to depression and anxiety disorders, schizophrenia, psychological distress, suicide, and substance abuse (D'Zurilla & Nezu, 2007), and is important to the overall coping process for fostering adaptive situational coping and behavioural competence.

Adjustment research. Research examining problem-solving and adjustment has consistently reported that problem-solving deficits are associated with poor adjustment (i.e., psychological distress, depressive symptoms, and anxiety; Nezu, 1985; 1986a; 1986b; 1987; Nezu & Carnevale, 1987) and that more effective problem-solving is associated with better adjustment as indicated by greater positive psychological well-being (i.e., Chang & D'Zurilla, 1996; Elliott, Herrick, MacNair & Harkins, 1994; see Chang, Downey & Salata, 2004 for review

of studies specific to problem-solving and positive psychological functioning). Health behaviour studies examining adjustment relative to acute and chronic health conditions such as spinal cord injury, cancer, pain, and depression consistently illustrate that there is support for associations between adjustment and problem-solving (i.e., Elliott, Godshall, Herrick, Witty & Spruell, 1991; Nezu, Nezu, Friedman & Houts, 1999; Elliott, 1992).

Interventions for enhancing adjustment through improved social problem-solving skills have been promising, and the evidence supports the use of these interventions among individuals with chronic conditions such as cancer. Interventions in the cancer population have effectively targeted problem-solving skills to reduce psychological distress and symptom-related limitations related to cancer and improve overall quality of life (Doreenbos et al., 2005; Nezu, Nezu, Felgoise, McClure & Houts, 2003). Problem-solving research has consistently reported associations between problem-solving ability and health behaviours such as alcohol use (Heppner, Hibbel, Neal, Weinstein & Rabinowitz, 1982; Williams & Kleinfelter, 1989) and risky driving or accident prevention behaviours (Dreer, Elliott & Tucker, 2004; Elliott et al, 1997; Elliott, Grant & Miller, 2004). An important component of disease management includes adherence (e.g., adherence to medication). There is evidence to suggest that problem-solving training may be effective for fostering adherence to treatment regimens in various clinical populations managing chronic pain, cancer, diabetes, and obesity (see D'Zurilla 1986; Turk et al., 1986; cf. Meichenbaum & Turk, 1987).

Physical activity research. One known study has examined problem-solving as a potential correlate of activity patterns. Using a sample of 96 undergraduate students, Godshall and Elliott (1997) examined the relationship between problem-solving variables and (1)

strenuous exercise and (2) the sedentary leisure activity of television viewing. Activity was measured retrospectively and prospectively via daily logs completed over two weeks. After accounting for gender differences, both retrospective and prospective logged accounts indicated that problem-solving skills were significantly associated with television viewing, with ineffective problem-solvers reporting greater television viewing as compared to their counterparts who were effective problem-solvers. However, strenuous exercise was not significantly associated with any problem-solving variables. Notably, exercise behaviour was examined generally, not relative to a problem, which could be one potential explanation for the poor association between problem-solving and exercise behaviour. Furthermore, variables that either precede or follow exercise behaviour, such as exercise social cognitions, were not examined.

Problem-Solving in Physical Activity

Although there is little research in the physical activity literature on the problem-solving process, the importance of problem-solving has been acknowledged. Several reviews point out the importance of self-efficacy beliefs and problem-solving skills as components of interventions that promote adherence to health behaviours (e.g., physical activity and dietary changes; Artinian et al., 2010; Conn et al., 2003; Kahn et al., 2002). However, studies reported within these reviews generally listed problem-solving as part of a larger intervention package to promote health behaviour change. Their findings are the outcomes generated by the multi-component intervention. As this represents the only evidence in physical activity where problem-solving has been utilized, it is not possible to draw conclusions about problem-solving as a behavioural strategy or about problem-solving as a process, given that problem-solving is not assessed. From both predictive and experimental perspectives, we know little about problem-solving in relation

to exercise-related problems such as a lapse, and little about correlates of problem-solving in exercise, which potentially describe how it impacts exercise behaviour following a lapse.

Faced with multiple gaps in the PA literature relative to problem-solving, the overall purpose of this dissertation was to initiate descriptive studies to determine if problem-solving relates to exercise-related social cognitions known to be related to adherence. Determining if problem-solving is related to variables that affect the self-regulation of exercise adherence may help to confirm if relationships shown in other areas of problem-solving research (i.e., other health behaviours) also apply to exercise.

Using two frameworks that describe problem-solving, three studies were conducted to examine proposed relationships between problem-solving and social cognitions that are known to be linked to exercise adherence. This series of studies investigated theoretical relationships among various asymptomatic and symptomatic exercising samples when they faced significant challenges related to their regular exercise. All studies exposed participants to stimulus materials that described a relevant problem appropriate for each study sample. Study 1 consisted of two parts, each of which examined proposed relationships relative to problem-solving, as suggested by social cognitive theory and MSPS. This was an initial, first generation level study to demonstrate theoretical tenets relative to problem-solving in exercise. Study 2 examined these relationships within a sample of active cardiac rehabilitation (CR) patients. Problem-solving is proposed to be useful within this sample given that numerous lifestyle changes associated with attending CR can be challenging, require persistence, and that lapses can occur. This study examined potential aspects of process through which problem-solving may influence adherence. MSPS tenets describing relationships between problem-solving and adherence-related social

cognitions (self-efficacy and persistence) were examined relative to two distinct aspects of the problem-solving process, (1) identifying solutions to problems, and (2) implementing solutions. Study 3 examined problem-solving and exercise-related social cognitions in a sample of active cancer survivors, and also examined these relationships with a specific focus on variables indicative of positive psychological functioning. In accordance with MSPS hypotheses, differences were sought between more and less effective problem-solvers on social cognitions known to be related to exercise. To address recommendations in the problem-solving literature (D'Zurilla & Nezu), the link between problem-solving and positive psychological functioning was also explored.

STUDY 1A: EXAMINING THE RELATIONSHIP BETWEEN SELF-REGULATORY EFFICACY AND PROBLEM-SOLVING APPROACH.

Self-Efficacy, Problem-Solving, and Exercise Adherence

According to Bandura and others, self-efficacy beliefs can impact how an individual adjusts to problems (Bandura, 1997; Maddux and Gosselin, 2003). Strong efficacy beliefs produce greater cognitive efficiency, which in turn, influences individuals' problem-solving approach to be more task-directed. Specifically, individuals with higher self-efficacy for solving problems use their cognitive resources more effectively. As a result, these individuals are better problem solvers, and consequently, offer better solutions and experience greater achievement than individuals who doubt their cognitive skills. It is theorized that in the face of difficulty, individuals with high self-efficacy beliefs are more likely to be *task-diagnostic* and continue to search for solutions to problems, while individuals with low self-efficacy are likely to become *self-diagnostic* and reflect on their inadequacies. This self-focus distracts them from their efforts to assess and solve the problem (Bandura, 1997; Maddux and Gosselin, 2003).

This theoretical contention is important in the investigation of exercise adherence because individuals may inevitably experience periodic exercise lapses, which they may view as problems to overcome. The management of exercise lapses may be linked to individuals' problem-solving approach and self-efficacy beliefs. The relationship between self-regulatory efficacy beliefs and problem-solving approach (task and self-diagnostic) has not systematically been examined in an exercise context. The current study is an initial (i.e., first generation) research study to examine theoretical relationships proposed within the social cognitive perspective of problem-solving.

Purpose and Hypotheses

The primary purpose of this study was to examine the proposed theoretical link between self-regulatory efficacy (SRE) and problem-solving approach. A secondary purpose of this study was to examine relationships between social cognitive and process variables proposed by social cognitive theory to be relevant to exercise adherence. Accordingly, theoretical relationships examined as part of this secondary purpose were between SRE for exercise, and factors that could affect the response to a problem such as perceived difficulty, and anticipated persistence with exercise (Bandura, 1997; Jung & Brawley, 2011), in the face of a problem. These relationships have not been previously examined in exercise research with respect to problem-solving.

The following hypotheses were advanced: Relative to the primary purpose, it was expected that SRE beliefs would be related to problem-solving approach. Specifically, when faced with an exercise lapse-related problem, individuals' SRE beliefs were expected to be positively related to task-diagnostic problem-solving approach (hypothesis 1) and negatively related to self-diagnostic problem-solving approach (hypothesis 2). It was also expected that when an exercise lapse-related problem was introduced, task-diagnostic problem-solving approach would be negatively related to extent of change in SRE beliefs (hypothesis 3). For example, individuals with higher task diagnostic problem-solving were expected to sustain SRE beliefs despite the introduced problem. Relative to the secondary purpose, it was hypothesized that SRE beliefs would be positively related to anticipated persistence with exercise in the face of an exercise problem (hypothesis 4), and that perceived difficulty of the problem would be negatively related to persistence with exercise in the face of a problem (hypothesis 5).

Method

Participants and Design

Seventy-nine university students and employees (94 per cent female) volunteered to take part in this correlational, observational study. Participants were between the ages of 18 and 51 (*Mean age* = 25.8 years, *SD* = 7.8). Seventy-one percent were single and 25 per cent were married or in a common-law relationship. All participants were regularly attending structured, instructor-led exercise sessions (at least 2 times per week). Over 91 per cent of the sample confirmed that most of the time they preferred being instructed by a knowledgeable trainer or class instructor where the exercise was planned, delivered, and completely guided (i.e. frequent/constant contact with a class instructor or trainer).

Recruitment and Inclusion

Following approval from the University of Saskatchewan Behavioural Research Ethics Board (see Appendix A), participants were recruited using posters around the university and through visitations to classrooms and exercise classes on the university campus. The main university web system was also used to advertise the study. To be included in the study, participants were required to regularly take part in structured, instructor-led exercise sessions (at least 2 times per week). It was also required that these sessions were the primary mode of exercise. These criteria were in place so that participants had some experience with attending a structured, instructor-led session and could relate to the content presented in the study stimulus material. Individuals who regularly (i.e., 3 times per week) took part in exercise that was self-guided (not instructor-led) were excluded from the study on the basis that they would not rely on attending classes for exercise and would likely be able to self-manage independent exercise

successfully, and would not view the stimulus material as a legitimate problem that could lead to a lapse.

Measures

All Study 1A measures are outlined below. A complete version of these measures is available in Appendix B.

Demographics. For the purpose of describing the sample, participants were asked to provide information about their gender, age, marital status, student/employee status, and college of study, if applicable.

Self-regulatory efficacy for exercise. To assess participants' confidence in their ability to manage their exercise, participants responded to an 8-item measure pertaining to behaviours necessary to self-regulate exercise over the next 4 weeks, such as scheduling exercise, planning exercise sessions, overcoming barriers that may interfere with exercise, and preventing relapse by overcoming temporary exercise lapses. An example item from this scale is, "Over the next 4 weeks, how confident are you that you can arrange your weekly schedule in order to do your exercise no matter what?". Items were assessed using a confidence scale ranging from 0 per cent (*not at all confident*) to 100 per cent (*completely confident*), and were in accordance with recommendations in the literature (Bandura, 1997; McAuley & Mihalko, 1998; Woodgate, Brawley, & Weston, 2005). The mean for all 8 items was computed for each participant and used in the analyses. These items were assessed both at baseline and after reading the stimulus material (post-problem) and instructions were adapted for the baseline and post-problem assessments appropriately. For the baseline assessment, participants were asked to rate their confidence for the listed behaviours, whereas for the post-problem assessment, participants were

instructed to first recall the problem scenario that was described in the stimulus material, then rate their confidence for the listed behaviours after considering the problem in the scenario. These items have been used previously in exercise research, in which internal consistencies ranged from .84 to .93 (e.g., Woodgate & Brawley, 2008). This scale had excellent internal consistency (Cronbach's $\alpha = .90$ for baseline and .95 for post-problem; Tabachnick & Fidell, 2007).

Problem-solving approach. To assess task-diagnostic and self-diagnostic problem-solving approach, participants responded to a 22-item measure that was developed to assess these approaches. Measures of problem-solving available in the problem-solving literature do not specifically assess task-diagnostic and self-diagnostic problem-solving approaches. Therefore, items were constructed using the conceptualizations and examples from the literature (Bandura, 1997; Maddux & Gosselin, 2003; Maddux & Lewis, 1995). Participants responded to these items in reference to the written scenario, which described that the classes they attended were completely cancelled for the next 4 weeks. Participants were instructed to recall the stimulus material and to reflect on the scenario presented in the stimulus material before rating the degree to which each statement reflected their thoughts. Example items are, "I brainstormed possible solutions for overcoming the problem and getting exercise" (task) and "I was reminded of previous times when I could not attend structured classes and how I didn't deal with this well" (self). Participants responded on a scale of 0 (*doesn't reflect my thoughts at all*) to 7 (*reflects my thoughts very much*). Separate means for items in the task-diagnostic subscale (9 items) and items in the self-diagnostic subscale (13 items) were computed for each participant and used in the analyses. Good internal consistency was reported for task-diagnostic problem-solving

(Cronbach's $\alpha = .86$) and self-diagnostic problem-solving subscales (Cronbach's $\alpha = .85$; Tabachnick & Fidell, 2007).

Anticipated persistence. Participants assessed 4 items to indicate their anticipated persistence with carrying out their planned exercise each week and maintaining their current exercise frequency despite the exercise problem presented in the stimulus material (i.e., their exercise classes were completely cancelled for the next 4 weeks). Participants rated the degree to which they anticipated persisting with their exercise by indicating how much (1) time and (2) attention they were willing to put forth, (3) they were willing to persist, and (4) attention they were willing to direct toward carrying out their planned exercise and maintaining their current exercise frequency each week. An example item is, "Each and every week, how much effort are you willing to put forth in order to carry out planned exercise and maintain your current exercise frequency for the next 4 weeks?". Participants responded on a scale of 1 (*little or none*) to 9 (*as much as it takes*). The mean for all 4 items was computed for each participant and used in the analyses. This measure has previously been used in exercise adherence research concerning exposure to exercise barriers (Jung & Brawley, 2011) and reported excellent internal consistency (Cronbach's $\alpha = .95$). The scale was internally consistent at an excellent level (Cronbach's $\alpha = .93$; Tabachnick & Fidell, 2007).

Perceived difficulty. Participants assessed their perception of how difficult it would be to carry out planned exercise and maintain current exercise frequency over the next 4 weeks when faced with the exercise problem in the stimulus material. Perceived difficulty was measured using one item, "How difficult do you believe it would be to maintain your current

exercise frequency over the next 4 weeks?”. The item was phrased in relation to the problem. Participants responded using on a scale of 1 (*not at all difficult*) to 9 (*extremely difficult*).

Problem check and message quality checks. These were used to verify that the stimulus material was actually perceived by participants to be a problem, and that the quality of the written message was high.

Problem check. One item that assessed perceived difficulty of the problem (described above) was used as a problem check to ensure that participants did actually perceive the stimulus material as a difficult problem. A second item, "The written scenario presented a challenging situation", was also used to check the difficulty of the problem.

Message quality checks. The quality of the message was assessed using 3 items. Items were, “The written scenario presented a challenging situation,” “The written scenario was aimed at people like me,” and “The written scenario was believable.” Participants responded on a scale of 1 (*strongly disagree*) to 9 (*strongly agree*). Scores for each of the three items were reported.

Stimulus Material

Exercise-related problem. The stimulus material was a written scenario that described a situation in which the regularly exercising participant was faced with an exercise-lapse related problem. Written scenarios have successfully been used as part of an intervention to promote self-management of health-related behaviours (See Mancuso, Sayles, Robbins & Allegrante, 2010), and have also been used successfully in past exercise research (e.g., Brawley, Glazebrook, Spink & Jung, 2010; Priebe, Flora, Ferguson & Anderson, 2012; Strachan, Flora, Brawley & Spink, 2011). In the current study, the stimulus material described that the class which the

participant regularly attended was cancelled without notice and completely unavailable for the next 4 weeks. See Appendix C for stimulus material.

Procedure

Pilot testing. Prior to the main study, a pilot study was conducted to test the stimulus material. Participants for the pilot study ($n = 7$) were recruited using the same method as described for the main study and were similar to participants in the main study in that they regularly participated in structured, instructor-led exercise as their primary mode of activity. Participants in the pilot study read the stimulus material, completed all measures, and engaged in a discussion with the researcher to respond to a series of questions about the scenario and measures. Participants involved in the pilot study reported that they could relate to the stimulus material and that it presented a scenario that they perceived to be challenging and believable. Feedback received about the stimulus material and measures informed revisions to enhance readability and clarity of the stimulus material and measures. Data collected during this pilot phase were not included in the main study. All descriptions that follow are related to the main study only.

Assessments. All participants completed the study online. Participants were emailed a secure link to an online web-based survey. They first completed the consent form before completing all measures. Next, participants completed demographics and a baseline measure of SRE for exercise. After completion of baseline measures, they read the stimulus material which described a situation in which a regular exerciser like themselves was faced with an exercise-related problem. Participants were instructed as follows: “Please read the following scenario carefully and try to place yourself in the situation described. The questions which follow will be

in reference to how you would react to the situation.” Participants then completed all remaining measures including post-problem measure of SRE for exercise, problem-solving approach (task and self-diagnostic), anticipated persistence, perceived difficulty, and all problem and message quality checks.

Analytic Plan

Two separate hierarchical multiple regression analyses were conducted to examine hypotheses 1 and 2. Relative to the primary purpose, separate analyses were conducted to examine the relationships between SRE and (1) task-diagnostic problem-solving approach and (2) self-diagnostic problem-solving approach. In each model, baseline SRE and perceived difficulty were entered as covariates (blocks 1 and 2). These variables were entered as covariates to control for baseline SRE scores and perceived difficulty, which were expected to be related to task-diagnostic problem-solving. Next, post-problem SRE was entered as the predictor variable (block 3), and problem-solving approach was the dependent variable.

A third regression analysis was conducted to examine the relationship between task-diagnostic problem-solving approach and change in SRE beliefs following the introduction of an exercise lapse-related problem. In this model, task-diagnostic problem-solving approach was the predictor variable and change in SRE beliefs was the dependent variable.

Relative to the secondary purpose, a fourth hierarchical multiple regression analysis was conducted to examine social cognitive theory-based relationships. Baseline SRE was entered in block 1 to examine the amount of variance it accounted for in persistence. Perceived difficulty, a known covariate (Bandura, 1986, 1997) and SRE were entered as covariates in block 2 to

account for their combined variance. Post-problem SRE was entered in block 3. Anticipated persistence was the dependent variable.

Results

Data Management

Data management strategies were employed to address missing data and the presence of outliers. The same process was used for all studies in this dissertation, but a complete description is only provided here to avoid redundancy. All steps were in accordance with recommendations made by Tabachnick and Fidell (2007).

Missing data. The data were examined to ensure that any missing responses were random. When one item was missing from a scale, the mean for the remaining items in that scale was used to replace the missing value. For example, three participants were missing one item each for baseline SRE and one participant was missing one item for post-problem SRE. Five participants were missing one item each in the problem-solving approach measure. In each example, the participant's mean for the answered items in the scale were used to replace the missing values. When all items for a given scale were missing, the sample mean for each item was used to replace the missing scores, as recommended by Tabachnick and Fidell (2007).

Outliers. The procedures outlined by Tabachnick and Fidell (2007) were employed to detect outliers. Outliers were sought statistically using the benchmark of a standardized score greater than 3.29 ($p < .001$) away from all other scores for that specific variable. No outliers were detected.

Testing of assumptions. Prior to conducting the analyses, assumptions of a regression analysis were examined and determined to be non-problematic. Assumptions examined were that there were no outliers, that a sufficient number of cases were available, that there was no multicollinearity or singularity, normality, linearity, and homoscedasticity of residuals, reduced measurement error, and independence of errors (Tabachnick and Fidell, 2007).

Descriptive Statistics

Demographic variables. A total of 99 volunteers provided informed consent to participate in the study. Twenty individuals did not meet the inclusion criteria and were excluded from the study. The total sample consisted of 79 participants. Of these participants, 94 per cent were female and 86 per cent identified themselves as current university students while 10 per cent identified themselves as university employees. Student participants reported that they were enrolled in a variety of colleges (i.e., 35 per cent in Arts and Science, 43 per cent in one of Medicine, Law, Pharmacy, Agricultural and Bioresources, and Engineering, less than 3 per cent in Kinesiology).

Descriptive data. Participants' mean scores and standard deviations for study variables are presented in Table 1. Correlations between main study variables are available in Appendix D.

Table 1

Means for All Study Variables

Variable	<i>M (SD)</i>
Self-Regulatory Efficacy (baseline)	69.70 (17.82)
Self-Regulatory Efficacy (post-problem)	59.05 (21.74)
Perceived Difficulty	4.65 (1.98)
Anticipated Persistence	5.88 (1.93)
Task-diagnostic Problem-Solving	4.80 (1.38)
Self-Diagnostic Problem-Solving	2.36 (1.33)

Note. Scale range for variables is as follows: Self-regulatory efficacy (0-100); Perceived difficulty (1-9); Anticipated persistence (1-9); Problem-solving approach (0-7).

Self-regulatory efficacy and problem-solving approach. With respect to the primary purpose of the study, separate hierarchical multiple regressions revealed that all hypotheses were supported. Findings indicate that the covariates, baseline SRE and perceived difficulty, significantly predicted task-diagnostic problem-solving approach. Baseline SRE was positively related to task-diagnostic problem-solving approach and perceived difficulty was negatively related to task-diagnostic problem-solving approach. After controlling for covariates, post-problem SRE significantly predicted task-diagnostic problem-solving approach, revealing a positive relationship, $F\Delta(1, 75) = 14.2, p < .001$ (hypothesis 1 supported). Results for R^2 , R^2 change, and standardized beta coefficients are presented in Table 2.

Similarly, findings indicate that the covariates significantly predicted self-diagnostic problem-solving approach. Baseline SRE was negatively related to self-diagnostic problem-

solving approach and perceived difficulty was positively related to self-diagnostic problem-solving approach. After controlling for covariates, post-problem SRE significantly predicted self-diagnostic problem-solving approach, $F\Delta (1, 75) = 6.8, p < .05$, indicating a negative relationship (support for hypothesis 2). Results for R^2 , $R^2\text{change}$, and standardized beta coefficients are presented in Table 3.

Consistent with hypothesis 3, task diagnostic problem-solving approach significantly predicted change in SRE beliefs, $R^2\text{change} = .15, p < .001, F\Delta (1, 77) = 14, \beta = -.39, p < .001$. This finding indicates that task-diagnostic problem-solving is a significant predictor of change in SRE beliefs following the presentation of a problem. The negative direction of the relationship, as indicated by the negative standardized beta, indicates that individuals exhibiting a stronger task-diagnostic problem-solving approach reported less change in SRE beliefs and better sustained their SRE in the face of an exercise problem.

Table 2

Predictors of Task-Diagnostic Problem-Solving Approach

Predictor	Task-Diagnostic		
	R^2	$R^2\Delta$	β
Step 1		.20***	
Baseline SRE			.45***
Step 2	.39	.19***	
Baseline SRE			.33*
Perceived Difficulty			-.45***
Step 3	.49	.10***	
Baseline SRE			.10
Perceived Difficulty			-.22*
Post-Problem SRE			.48***
Total model $R^2\text{adjusted}$.47***		

Note. $N = 79$. * $p \leq .05$, ** $p \leq .01$ *** $p \leq .001$.

Table 3

Predictors of Self-Diagnostic Problem-Solving Approach

Predictor	Self-Diagnostic		
	R^2	$R^2\Delta$	β
Step 1		.17***	
Baseline SRE			-.42***
Step 2	.22	.05*	
Baseline SRE			-.36***
Perceived Difficulty			.22*
Step 3	.28	.07**	
Baseline SRE			-.17
Perceived Difficulty			.04
Post-Problem SRE			-.39***
Total model $R^2_{adjusted}$.25**		

Note. $N = 79$. * $p \leq .05$, ** $p \leq .01$ *** $p \leq .001$.

Social-cognitive theory-based relationships. With respect to the secondary purpose, a hierarchical multiple regression revealed that hypotheses 4 and 5 were supported. Consistent with hypothesis 4, findings indicate that baseline SRE and post-problem SRE significantly predicted anticipated persistence. Consistent with hypothesis 5, when perceived difficulty is regressed individually with anticipated persistence, an inverse relationship is observed ($R^2_{adjusted} = .11, p < .01, \beta = -.34$). As well, when perceived difficulty was entered as a covariate along with baseline SRE, this inverse relation was also suggested by the negative standardized beta (See Table 4). However, perceived difficulty was no longer a significant predictor of anticipated persistence after post-problem SRE was entered into the model in the third block. R^2 , R^2_{change} , and standardized beta coefficients are reported in Table 4 below.

Table 4

Social Cognitive Theory-Based Relationships

Predictor	Anticipated Persistence		
	R^2	$R^2\Delta$	β
Step 1		.27***	
Baseline SRE			.52***
Step 2	.33	.05*	
Baseline SRE			.46***
Perceived Difficulty			-.23*
Step 3	.40	.08**	
Baseline SRE			.25*
Perceived Difficulty			-.03
Post-Problem SRE			.43**
Total model $R^2_{adjusted}$.47***		

Note. $N = 79$. * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

Problem check and message quality checks. All checks were reported on a 1 to 9 scale. Perceived difficulty was reported to be 4.68 ($SD = 1.97$), indicating that the scenario described in the message was perceived to be moderately difficult. The item to check difficulty of the problem and quality of the message indicated that the stimulus material presented a problem that was of above average challenge ($Mean = 5.9$, $SD = 2.2$). Further, the remaining message quality check items indicated that participants reported that the stimulus material was believable ($Mean = 6.6$, $SD = 2.0$) and that the person described in the stimulus material was someone like them ($Mean = 5.8$, $SD = 2.3$).

Post-hoc regressions examining social cognitions and exercise adherence. The study findings indicate that SRE beliefs are significantly related to (a) anticipated persistence in the face of a problem and (b) task-diagnostic problem-solving approach. An interesting alternative question that arises as a result of these findings is about the relationship between problem-

solving approach and anticipated persistence with exercise. Proposed theoretical tenets about the relationship between SRE beliefs and persistence are empirically supported, however, the potential contribution of a task-diagnostic problem solving approach to an individual's persistence when faced with a problem remains unexamined. Does a task-diagnostic problem-solving approach predict an individual's persistence with exercise in the face of a problem? If so, what are the relative contributions of both task-diagnostic problem-solving approach and SRE beliefs when these variables are examined together?

To investigate these questions, a hierarchical multiple regression (HMR) procedure was used. Baseline SRE and perceived difficulty were entered as covariates in blocks 1 and 2, respectively. Post-problem SRE and task-diagnostic problem-solving approach were entered together as the predictor variables in block 3. R^2 , R^2 change, and standardized beta coefficients for this HMR are reported in Table 5 below.

Table 5
SRE and Problem-Solving Approach

Predictor	Anticipated Persistence		
	R^2	$R^2\Delta$	β
Step 1		.27***	
Baseline SRE			.52***
Step 2	.33	.05*	
Baseline SRE			.46***
Perceived Difficulty			-.23*
Step 3	.46***	.13***	
Baseline SRE			.22*
Perceived Difficulty			.04
Post-Problem SRE			.28*
Task-Diagnostic approach			.32**
Total model R^2 adjusted	.43***		

Note. $N = 79$. * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

As expected, the covariates (baseline SRE and perceived difficulty) significantly predicted persistence. After controlling for the covariates, the predictor variables (post-problem SRE and task-diagnostic problem-solving approach) accounted for a significant amount of additional variance in anticipated persistence, as indicated by the significant R^2 change in step 3. The overall model accounted for 43 per cent of the variance in anticipated persistence. Standardized beta coefficients for post-problem SRE and task-diagnostic problem-solving approach indicate that both predictors were positively related to anticipated persistence.

Discussion

The main objective of this study was to determine if there was a relationship between self-regulatory efficacy (SRE) and problem-solving approach. A secondary purpose was to examine relationships between correlates of exercise adherence, which are proposed by social cognitive theory, but have not been specifically examined relative to problem-solving.

The current study findings provide support for each of the hypotheses (1 through 5) that were advanced in consideration of these purposes. Relative to the primary purpose, the proposed relationship between SRE and problem-solving approach was supported. When individuals faced an exercise-related problem, SRE beliefs were positively related to task-diagnostic problem-solving approach and negatively related to self-diagnostic problem-solving approach. Furthermore, the relationship between task-diagnostic problem-solving and change in SRE indicated that individuals with a strong task-diagnostic problem-solving approach, who focus on finding solutions to problems, sustain their SRE for exercise despite problems. This conclusion is suggested by the significant negative association between task-diagnostic problem-solving and change in SRE scores. Specifically, individuals who reported the strongest focus on seeking

solutions reported the least amount of change in SRE scores post-problem, indicating that they remained confident that they could manage their exercise despite the problem.

Relative to the secondary purpose, the relationships between SRE, difficulty and anticipated persistence agree with the agency aspect of social cognitive theory. These results extend current knowledge about these relationships in many general exercise contexts to an exercise-lapse context when individuals are focused on a problem. The investigation of these relationships more specifically examined Bandura's suggestion that the detection of such relationships would be evident when an individual is presented with a challenging situation (i.e., a problem). There are currently few examinations of the SRE, difficulty, and persistence relationships among asymptomatic individuals who regularly take part in exercise. Further, with the exception of one study in exercise, (Jung & Brawley, 2011), the SRE-difficulty-persistence relationships have not been explored when participants are faced with problems.

STUDY 1B: EXAMINING THE RELATIONSHIP BETWEEN PROBLEM-SOLVING EFFECTIVENESS AND EXERCISE OUTCOMES.

Numerous benefits are obtained through regular exercise, however, lapses in exercise may be inevitable. An individual's adjustment in the face of a lapse may influence future adherence. Within the problem-solving literature, the Model of Social Problem-Solving (MSPS) has been used to examine the role of problem-solving in adjustment and may be a useful framework to examine exercise lapses. According to this framework, two processes determine outcomes in the face of a problem: problem orientation and problem-solving style. *Problem orientation* reflects individuals' general awareness about problems, such as their tendency to recognize or ignore problems, and their perception of problems, including general thoughts about problems and their ability to solve them. Problem orientation is characterized by two dimensions: positive problem orientation (PPO) and negative problem orientation (NPO). *Problem-solving style* reflects the cognitive and behavioural activities by which an individual attempts to understand and find effective solutions to problems. It consists of three dimensions: rational problem-solving (RPS), impulsivity/carelessness style (ICS), and avoidance style (AS). Each dimension within these two processes is classified as either constructive or dysfunctional. PPO and RPS are constructive, while NPO, ICS, and AS are dysfunctional (D'Zurilla & Nezu, 2007; see general introduction for full description of MSPS). According to MSPS, more effective problem-solvers, or individuals who score relatively high on constructive dimensions and relatively low on dysfunctional dimensions, are likely to produce positive or adaptive outcomes. Conversely, less effective problem-solvers, or individuals who score relatively high on dysfunctional dimensions and relatively low on constructive dimensions, are likely to produce negative or maladaptive outcomes (D'Zurilla & Nezu, 2007).

While the hypothesized relationships proposed by MSPS have been supported by experimental and correlational research (D'Zurilla & Nezu, 2007), extant research has been limited primarily to the study of depression, anxiety disorders, schizophrenia, psychological distress, suicide, substance abuse, and offending behaviour. Social problem-solving has been examined relative to health behaviours and related findings seem to be consistent with relationships proposed by the model. For example, PPO (constructive) is associated with concern for accident prevention in college students, whereas AS (dysfunctional) is associated with more traffic risk-taking (Elliott et al., 1997). Further, Godshall and Elliott (1997) reported that less effective problem-solving skills were associated with more sedentary leisure activities. While research on social problem-solving and health behaviours has been promising, problem-solving has yet to be examined relative to exercise behaviour, and specifically, the management of lapses in exercise.

Purpose and Hypotheses

This is an initial research study to examine theoretical relationships proposed by MSPS, relative to exercise lapses. The relationships between problem-solving effectiveness and social cognitions that are known indicators of exercise adherence are examined in the face of an exercise lapse-related problem. Specifically, the relationships between global problem-solving effectiveness and (a) self-regulatory efficacy (SRE) for exercise, (b) anticipated persistence, and (c) specific problem-solving approach (see Study 1A: task-diagnostic and self-diagnostic) are examined.

It was hypothesized that when individuals are faced with an exercise lapse-related problem, their problem-solving effectiveness, as measured by the Social Problem Solving

Inventory, would be significantly positively related to (a) baseline SRE (hypothesis 1), (b) post-problem SRE (hypothesis 2), (c) anticipated persistence (hypothesis 3), and (d) task-diagnostic problem-solving approach (hypothesis 4), and (e) significantly negatively related to self-diagnostic problem-solving approach (hypothesis 5).

Method

The method for the current study was identical to study 1A. Readers are referred to study 1A for a complete description of the participants, study design, stimulus material, measures, and procedures for recruitment and assessment. One additional measure was assessed in the current study and is described below.

Measure

Problem-solving effectiveness. The Social Problem Solving Inventory-Revised (SPSI-R) was used to assess problem-solving effectiveness. The theory-based short version of the SPSI-R (D’Zurilla, Nezu, & Maydeu-Olivares, 2002) is a 25-item measure consisting of the five dimensions of MSPS. Some example items include, “When I have a problem, I try to see it as a challenge, or opportunity to benefit in some positive way from having the problem” (positive problem orientation), “When I am faced with a difficult problem, I doubt that I will be able to solve it on my own no matter how hard I try” (negative problem orientation), “When I am trying to solve a problem, I think of as many options as possible until I cannot come up with any more ideas” (rational problem-solving style), “When I am trying to solve a problem, I go with the first good idea that comes to mind” (impulsivity/carelessness style), and “I wait to see if a problem will resolve itself first, before trying to solve it” (avoidant problem-solving style). Items were assessed on a scale of 0 (*not at all true of me*) to 4 (*extremely true of me*). A total score for social

problem-solving was calculated in accordance with recommendations by the authors of the measure (D’Zurilla et al., 2002). The total problem-solving effectiveness score was out of 20 based upon weighting that included the 5 dimensions of MSPS.

The SPSI-R was derived from a factor analysis of D’Zurilla and Nezu's (1990) original theory-driven Social Problem-Solving Inventory (Maydeu-Olivares & D’Zurilla, 1995; 1996). Research indicates that the SPSI-R has strong internal consistency, with alpha coefficients ranging from .79 to .95 across five scales, and strong test-retest reliability, with correlation coefficients ranging between .89 and .93 for total score over a 30-week period among two different samples. Strong structural, concurrent, predictive, convergent, and discriminant validity have also been reported for the measure (D’Zurilla et al., 2002).

Analytic Plan

Separate regression analyses were conducted to examine each of the proposed hypotheses. Separate analyses were used to independently examine relationships between problem-solving effectiveness and baseline SRE, post-problem SRE, anticipated persistence, task-diagnostic problem-solving approach, and self-diagnostic problem-solving approach (hypotheses 1 through 5, respectively).

Results

Data Management

The data management for the current study was identical to study 1A. Readers are referred to study 1A for a complete description of data management strategies that were

employed. Management of the missing data from the SPSI-R measure assessed in the current study is described below.

Missing data. According to the authors of the SPSI-R, the maximum number of allowable omissions for the SPSI-R short form is two items. When missing items for the short version of the SPSI-R do not exceed the maximum allowable number, it is recommended that the means for the remaining items on the subscale with the missing value should be inserted for the participant. In this study, two participants were missing one item each, therefore in accordance with recommendations, mean values for the subscale were inserted. In two instances where missing items exceeded the maximum allowable number, sample means were inserted for missing items. This decision was made on the following basis: The SPSI-R is conventionally used in a clinical setting to identify and categorize ineffective problem-solvers into problem-solving training where specific problems (i.e., depression or health-related difficulties) can be addressed. However, the purpose of this initial study was to explore relationships between problem-solving effectiveness and exercise-related social cognitions, therefore, sample means insertion allowed retention of two participants and use of the whole sample for analysis.

Testing of assumptions. Prior to conducting the analyses, assumptions of a regression analysis were examined and determined to be non-problematic. Readers should refer to study 1A for a complete description.

Descriptive Statistics

Descriptive data. Participants' mean scores and standard deviations for study variables are presented in Table 6.

Table 6

Means for All Study Variables

Variable	<i>M (SD)</i>
Problem-Solving Effectiveness	13.65 (2.54)
Self-Regulatory Efficacy (baseline)	69.70 (17.82)
Self-Regulatory Efficacy (post-problem)	59.05 (21.74)
Anticipated Persistence	5.88 (1.93)
Task-diagnostic Problem-Solving	4.80 (1.38)
Self-Diagnostic Problem-Solving	2.36 (1.33)

Note. Scale range for variables is as follows: Problem-solving effectiveness (0-20); Self-regulatory efficacy (0-100); Anticipated persistence (1-9); Problem-solving approach (0-7).

Problem-solving effectiveness and exercise social cognitions. Results of the regressions revealed that problem-solving effectiveness significantly predicted (1) baseline SRE, $R^2_{adjusted} = .21$, $p < .001$, (2) post-problem SRE, $R^2_{adjusted} = .15$, $p < .001$, (3) task-diagnostic problem-solving, $R^2_{adjusted} = .09$, $p < .01$, and (4) self-diagnostic problem-solving, $R^2_{adjusted} = .13$, $p = .001$ (support for hypotheses 1, 2, 4 and 5). As hypothesized, problem-solving effectiveness was positively related to baseline SRE, post-problem SRE, and task-diagnostic problem-solving, and negatively related to self-diagnostic problem-solving. The hypothesized significant positive relationship between problem-solving effectiveness and anticipated persistence was not supported, $R^2_{adjusted} = .03$, $p = .08$.

Discussion

The main objective of this study was to examine relationships proposed by the model of social problem solving (MSPS) and aspects of agency relative to exercise lapses. The findings support hypotheses that when individuals are faced with an exercise lapse-related problem, individuals' overall problem-solving effectiveness would be related to exercise-related social cognitions that are known indicators of exercise adherence. Specifically, problem-solving effectiveness was positively related to self-regulatory efficacy beliefs, anticipated persistence, and task-diagnostic problem-solving approach. When confronted with a problem that challenged their adherence to their exercise regimen, more effective problem-solvers reported they would remain confident in their ability to maintain their exercise frequency and remain focused on seeking solutions related to the challenge. While the relationship between problem-solving effectiveness and persistence was not significant, the relationship was in the expected direction.

A negative relationship was observed between problem-solving effectiveness and self-diagnostic problem-solving approach, indicating that in the face of a problem-induced lapse more effective problem-solvers are less distracted with self-focused thoughts. Combined, these findings indicate that there is a positive relationship between more effective problem-solving, greater SRE, and social-cognitions about the pursuit of exercise adherence in the face of a problem that challenges adherence.

Study 1 General Discussion

Examination of Theory-Based Relationships Relative to Problem-Solving in Exercise

Studies 1A and 1B are first generation level (i.e., initial) research studies in which theory-based relationships relative to problem-solving in exercise were examined. These studies employed two well-investigated frameworks to examine social cognitions important in adjustment and relevant to the management of exercise lapses. The demonstrated relationships provide preliminary support for previously unexamined problem-solving questions relative to exercise. Study 1A findings lend support to the proposals of Bandura and others, indicating that self-efficacy beliefs are related to how an individual approaches and works through problems, as suggested by whether they remain focused (i.e., task vs. self) on finding a solution (Bandura, 1997; Maddux & Gosselin, 2003). Study 1B supports propositions by D'Zurilla and his colleagues that more effective problem-solvers are at an advantage with respect to overcoming problems (D'Zurilla & Nezu, 2007). In an exercise lapse context, when individuals are faced with a problem that might trigger an exercise lapse, those who have higher SRE beliefs may be more effective at finding solutions to overcome the problem. These people may avoid the experience of negative thoughts about self and situation that could deter problem-solving and implementation. Furthermore, those with more effective problem-solving skills may have more adaptive social cognitions, which may enable them to better self-regulate their exercise in the face of challenges. However, the observational pre-post design of this investigation limits causal inferences pertaining to these relationships.

Implications of these findings relative to exercise lapses are that more adaptive problem-solvers (i.e., more constructive, more task-focused) may be more likely to recover from problems

that may impede exercise. While this would need to be specifically examined using an experimental design, a reasonable hypothesis is that better problem-solvers may be more likely to remain regularly active and achieve health benefits associated with regular activity. While this behaviour is desirable in asymptomatic populations, it is particularly important among individuals with chronic health conditions that require regular exercise as part of condition management. For example, exercise therapy programs for individuals with chronic conditions (i.e., cardiovascular disease and arthritis) are available, however, regular attendance to these programs over the long term is problematic (Artinian et al., 2010; Marks & Allegrante, 2005). Building on the initial findings from Study 1, it would be interesting to investigate if problem-solving is related to lapses in exercise among individuals attending exercise therapy programs. Do more effective problem-solvers anticipate being more persistent through challenges that impede their attendance in exercise therapy? Are more effective problem-solvers at a social-cognitive advantage with respect to being motivated in the face of problems as compared to their less effective counterparts? These are questions that could be examined in future research about problem-solving and exercise among individuals who perceive a need to remain active to rehabilitate from health-related conditions. The premise behind a focus on such individuals is that a lapse-related exercise adherence problem is perceived as an issue of potentially greater importance for rehabilitating individuals than for individuals not dealing with recovering their health or lowering their risk of mortality.

Strengths and Limitations

One of the strengths of this preliminary investigation is its strong theoretical foundations. Specifically, two well-investigated psychological frameworks were employed to examine

problem-solving in exercise. Neither of these frameworks had previously been employed in research examining exercise lapses. Second, and related to theory, was the use of a validated measure of problem-solving. The short version of the SPSI-R, a validated measure of problem-solving effectiveness is based on MSPS. A methodological strength was that the problem presented in the stimulus material for Study 1 was verified as being a problem through pilot work prior to the main study and was also verified through problem checks in the main study. Both of these steps confirmed that the stimulus material presented a difficult problem to the study sample. Failure to confirm a problem as valid to study samples has been identified as an important limitation within problem-solving research. In previous research, clinicians and researchers often assume what is stressful and problematic to the study sample rather than determining this through direct interaction with the sample (Elliott, Grant & Miller, 2004). Thus confirming the validity and relevance of the problem in Study 1 fulfills recommendations in the problem-solving literature to consult participants about problematic situations prior to conducting the research. The quality of the stimulus material was confirmed using message quality checks, indicating it was challenging, believable, and that participants could relate to the similar person in the written material. Building on these methodological strengths, future research should seek information about problematic situations from the study sample and use checks to confirm the problem situation within the sample. This would be an important feature to include in both pilot and main study components in order to validate stimulus material.

However, this initial study is not without limitations. The first concerns the generalizability of the study findings. Considering that the study was conducted among a sample of young, regularly exercising females, the results are not generalizable to other populations. Finally, convenience sampling methods were used and participants were volunteers, therefore,

caution must be exercised when interpreting the findings, as they may not necessarily be an accurate representation of the larger exercising asymptomatic population of males and females.

STUDY 2: ADJUSTMENT TO CARDIAC REHABILITATION EXERCISE LAPSES: EXAMINATION OF THE PROBLEM-SOLVING PROCESS.

Managing Cardiac Rehabilitation Exercise

Exercise therapy is an integral component of cardiac rehabilitation (CR), yet non-adherence to CR therapy continues to be problematic (Chase, 2011). Individuals new to CR exercise therapy may face numerous challenges such as adjusting their current work schedule, negotiating and restructuring existing roles and responsibilities, taking new medication, and modifying their diet and exercise. Amidst the numerous demands, scheduling attendance to CR exercise is a self-regulatory challenge. Periodic lapses, or temporarily missing activity may be common and difficult to avoid (Lox, Martin Ginis & Petruzzello, 2006).

Successful self-regulation of exercise behaviour requires self-management including the use of cognitive-behavioural strategies such as goal-setting, self-monitoring, feedback, self-evaluative reactions to performance, self-efficacy beliefs, and problem-solving (Bandura, 2004; Barone et al., 1997; Maddux & Gosselin, 2003; Meichenbaum and Turk, 1987). These skills are important for preventing and managing lapses as part of adhering to behaviour, and are recognized to be important within the CR population for the self-regulation of health behaviours. In the latest guidelines for CR and cardiovascular disease prevention released by the Canadian Association of Cardiac Rehabilitation, the importance of self-management skills for improving patients' adherence to CR exercise is recognized (Prior, Francis, Reitav & Stone, 2009). It is recommended that CR programmes should facilitate the development of core skills identified to be important for the self-management of chronic disease (i.e., problem-solving, decision-making, resource utilization, partnership formation, action planning, self-tailoring; Lorig & Holman, 2003). Further, in a scientific position statement from the American Heart Association, Artinian

and colleagues (2010) reviewed intervention components that promote adherence to physical activity and dietary lifestyle changes among individuals with cardiovascular risk factors and recognized cognitive-behavioural strategies as essential components of these interventions (Artinian et al., 2010). One of the many skills described as important by these sources is problem-solving. The examination of problem-solving within the CR literature is particularly appropriate considering that CR involves major lifestyle changes and it is not uncommon for individuals to face problems that they must overcome in order to adhere to these changes. However, changes to health behaviours require that an individual persist over the long term, and adherence to these behaviours over the long term can be challenging (Ewart, 1990; Meichenbaum & Turk, 1987). As a possible acknowledgment of the potential for problem-solving skills to help patients manage these challenges, the CR guidelines state, “patients should learn how to define their disease-related problems and how to generate practical solutions to daily problems faced as a result of chronic illness” (p.147).

Problem-Solving in Cardiac Rehabilitation

Over two decades ago, Ewart (1990) advanced his position about the importance of problem-solving among patients with coronary heart disease. Ewart’s Social Problem-Solving Model (1990) is a framework by which to examine long-term change of health behaviours among patients with coronary heart disease. This model integrates core behavioural processes that are critical for long-term maintenance. The model posits that problem-solving competencies are of central importance. However, Ewart notes that problem-solving activities are insufficiently explored in previous adherence research.

Ewart's model can be viewed as a practical map to guide adherence promotion efforts, as it focuses on *processes*, which he defines as, “observable and potentially modifiable behavioral event sequences”. The importance of examining process components in intervention research seeking to promote adherence to behaviour change is echoed by Andersen, who notes that process components of interventions are under-examined, and that their examination is important in order to understand *how* intervention outcomes are achieved (Andersen, 1992; 2002). Despite these proposals, there remains a paucity of research that attempts to examine the potential links between problem-solving and exercise adherence. Problem-solving is recognized to be an important component of physical activity interventions, however, there is a lack of knowledge about *how* or *why* problem-solving improves adherence to exercise, as the variables potentially linking problem-solving and exercise adherence are seldom examined.

Self-Regulatory Efficacy, Persistence, and Problem-Solving

Self-regulatory efficacy and persistence are social cognitions that have been identified by social psychological frameworks to be important for behaviour change. Two guiding frameworks for this research describe the link between these social cognitions and problem-solving. The agency component of Bandura's social cognitive theory (SCT) posits that self-efficacy is related to persistence, and both variables are related to behaviour and the consistency required for self-regulation. Within his social problem-solving (SPS) model (1990), Ewart asserts that *persistence* in lifestyle change is a direct function of continued problem-solving activity, motivated by processes such as self-efficacy enhancement and social reinforcement. Both models recognize the importance of persistence and that it is a requisite for adherence. Both frameworks also emphasize the importance of self-efficacy. Accordingly, it seems

pertinent to investigate SRE and persistence relative to problem-solving because they are important process variables linked to exercise adherence in cardiac rehabilitation.

The Distinction Between Problem-Solving and Solution Implementation

An important consideration in the examination of problem-solving is the distinction between two components of the problem-solving process. The Model of Social Problem-Solving (MSPS; D'Zurilla, Nezu & Maydeu-Olivares, 2002) identifies the problem-solving process as consisting of two distinct components: problem-solving (PS) and solution implementation (SI). PS refers to the process of *finding solutions to specific problems*, whereas SI refers to the process of *carrying out such solutions* in actual problem situations (D'Zurilla & Nezu, 2007). PS and SI are conceptually different and require different sets of skills. The process of PS consists of three steps and is a general process that is applicable across most problems, requiring an individual to: (1) define the problem; (2) generate possible solutions; and (3) select a solution to implement. Conversely, the skills involved in carrying out solutions (SI) can vary widely, depending on the specific nature of problem and a given solution (D'Zurilla & Nezu, 2007). While both sets of skills are required for effective overall functioning and social competence, PS and SI may not always be correlated. For example, an individual may have strong PS skills and may be able to identify solutions effectively, but may have poor SI skills for implementation (D'Zurilla & Nezu, 2007). Considering this distinction, it is important to investigate both components of problem-solving.

Purposes of this Study

Compatible social-cognitive frameworks, Social Cognitive Theory (SCT; Bandura, 1997), Ewart's Social Problem-Solving Model (Ewart, 1990), and the Model of Social Problem

Solving (MSPS; D’Zurilla, Nezu & Maydeu-Olivares, 2002) are used as theoretical backdrop for this study.

Relationships between adherence-related social cognitions. Within the framework of SCT, the first purpose of this study was to examine the relationship between self-efficacy and anticipated persistence, social cognitions that are linked to exercise adherence. These relationships were examined among CR initiates when they are faced with an exercise-related problem.

Problem-solving predicting self-efficacy and persistence. The second purpose of this study was to identify potential indicators of process relative to problem-solving for exercise adherence. These relationships are proposed by the Ewart's social problem-solving model. Specifically, relationships between problem-solving effectiveness and exercise-related social cognitions that are theorized process variables known to be related to exercise behaviour (self-efficacy and anticipated persistence) were examined.

Differences in social cognitions as a function of PS effectiveness. According to MSPS, when faced with a problem, more effective problem-solvers have better solutions and outcomes compared to their less effective or ineffective counterparts. To examine this theoretical tenet relative to a CR sample, the third purpose of this study was to examine differences between more effective problem-solvers and less effective problem-solvers on exercise-related social cognitions, when they are faced with a CR exercise-related problem.

In addition to the focus on CR exercise management in this study, both PS and SI aspects were examined. Accordingly, all three purposes of the study were investigated relative to (1) CR

exercise, as well as two aspects of problem-solving that are distinguished in the literature, (2) problem-solving and (3) solution implementation.

Hypotheses

Relative to the first purpose, it was expected that self-efficacy would predict anticipated persistence relative to (1) CR exercise (hypothesis 1), (2) problem-solving (hypothesis 2), and (3) solution implementation (hypothesis 3). Specifically, it was expected that self-regulatory efficacy for CR exercise would predict anticipated persistence for CR exercise (hypothesis 1), self-efficacy for problem-solving would predict anticipated persistence with problem-solving (hypothesis 2), and self-efficacy for solution implementation would predict anticipated persistence for solution implementation (hypothesis 3). Relative to the second purpose, it was hypothesized that problem-solving effectiveness would predict self-efficacy and anticipated persistence relative to CR exercise (hypotheses 4 and 5), problem-solving (hypotheses 6 and 7), and solution implementation (hypotheses 8 and 9). Specifically, it was expected that problem-solving effectiveness would predict self-regulatory efficacy for CR exercise and anticipated persistence for CR exercise (hypotheses 4 and 5), problem-solving effectiveness would predict self-efficacy for problem-solving and anticipated persistence with problem-solving (hypotheses 6 and 7), and problem-solving effectiveness would predict self-efficacy for solution implementation and anticipated persistence for solution implementation (hypotheses 8 and 9). Relative to the third purpose, it was hypothesized that when faced with an exercise-related problem, more effective problem-solvers would report higher self-efficacy beliefs and anticipated persistence relative to CR exercise, problem-solving, and solution implementation, as compared to less effective problem-solvers (hypothesis 10). Specifically, more effective

problem-solvers were expected to report higher self-regulatory efficacy for CR exercise, anticipated persistence with CR exercise, self-efficacy for problem-solving, anticipated persistence with problem-solving, self-efficacy for solution implementation, and anticipated persistence for solution implementation than their less effective counterparts.

Method

Participants and Design

Fifty two participants (32 males and 20 females) who were enrolled in CR exercise programs in central Canada, and who fit the criteria of a CR initiate volunteered to take part in this correlational, observational study. Participants were between the ages of 33 and 82 years (*Mean* age = 65.6 years, *SD* = 10.8). All participants had been attending CR exercise at least once per week for at least 4 weeks. On average, participants were attending 2.8 (*SD* = .46) sessions of CR exercise per week and spent an average of 45 minutes in each session. Seventy-five per cent also reported engaging in independent physical activity outside of CR exercise, as recommended by staff, with most (71 per cent) reporting one to two exercise sessions in addition to structured CR exercise. Most participants (89 per cent) were married, half were retired (54 per cent), and 35 per cent were working. Most (89 per cent) reported this was their first time attending CR. Thirty one percent reported never smoking and almost sixty percent reported being a past smoker. Participants reported a mean BMI of 29.1 kg/m² (*SD* = 5.1), classifying them as being overweight. Their mean number of co-morbidities were 2.1 (*SD* = 1.4), with the most common being high blood pressure, high cholesterol, arthritis and diabetes.

Recruitment and Inclusion

Following approval from the relevant institutional ethical review boards (see Appendix E), participants were recruited using posters around three facilities where CR programs in two different Canadian municipalities took place. Exercise therapists who worked with patients at each site were also involved with recruiting participants for the study. The recruitment capacity and instruction were identical at each site. Potential CR initiates were identified based on eligibility criteria and willingness to hear more about the investigation. Participants who started CR within the past three months, or had not yet graduated from the entry-level component of the program were considered CR initiates. Recruitment was challenging in terms of time to recruit from three programs. Despite excellent cooperation from the three program sites with participant recruitment for the study, obtaining the sample from the programs took the better part of eleven months to complete.

Participants were required to regularly participate in structured CR exercise (at least one day per week for the past 4 weeks) so that they would have a frame of reference about regularly attending CR exercise and their ability to address some of the problems that arise while trying to attend CR exercise. Having at least one grandchild or a relationship with someone to whom they would relate in a similar way was also a criterion to ensure that participants would find the content of the problem stimulus material (see below) to be relevant and could relate to it.

Measures

All Study Two measures are outlined below. A complete version of these measures is available in Appendix F.

Self-regulatory efficacy for cardiac rehabilitation exercise (SRE-CR). Participants' confidence in their ability to manage CR exercise behaviour in the face of a problem was assessed using the eight-item measure that was used to assess SRE for exercise in Study 1A. Readers are referred to Study 1A for a complete description of the measure. The measure was modified to be applicable for CR exercise. An example item from this scale is, "Over the next 4 weeks, how confident are you that you can arrange your weekly schedule in order to attend cardiac rehabilitation no matter what?". Items were assessed using a confidence scale ranging from 0 per cent (*not at all confident*) to 100 per cent (*completely confident*). The mean for all 8 items was computed for each participant and used in the analyses. This scale had excellent internal consistency (Cronbach's alpha = .92; Tabachnick & Fidell, 2007).

Anticipated persistence with CR exercise. Participants' anticipated persistence to attend CR and maintain their current exercise despite the exercise problem presented in the stimulus material was assessed using the same four-item measure that was used to assess anticipated persistence in Study 1A. Readers are referred to Study 1A for a complete description of the measure. The measure was modified to be applicable for CR exercise. An example item is, "Each and every week, how much effort are you willing to put into finding a way to attend cardiac rehabilitation and maintaining your current exercise frequency for the next 4 weeks?". Participants responded on a scale of 1 (*little or none*) to 9 (*as much as it takes*). The mean for all 4 items was computed for each participant and used in the analyses. The scale was internally consistent at an excellent level (Cronbach's alpha = .95; Tabachnick & Fidell, 2007).

Self-efficacy for problem-solving (SEPS). To assess participants' confidence in their ability to *find solutions to specific problems* by engaging in the three steps of the problem-

solving process, participants completed a nine-item measure that assessed confidence in their ability to (a) define the problem (2 items), (b) generate possible solutions (2 items), and (c) select a solution to implement (5 items) in relation to the problem presented in the stimulus material. These items were developed based on descriptions of the framework presented by Chang, D’Zurilla, and Sanna (2004) and also followed recommendations for measuring self-efficacy. Stems and example items from this scale are as follows: “After reading the scenario, and before drawing any conclusions about what exactly the problem is, what caused it, or how you will solve it, please rate how confident you are that you can: Describe the problem objectively, separating facts from assumptions.” (Defining the problem); “After reading the scenario, if you were asked to brainstorm all the possible solutions that you could think of, please rate how confident you are that you can: Think of as many possible solutions as you can without evaluating them.” (Generating possible solutions); “After brainstorming all the possible solutions, and considering each idea to be equal in quality and potential (don’t judge them), please rate how confident you are that you can: Identify a plan of action which maximizes the positive consequences and minimizes the negative consequences.” (Selecting a solution to implement). Items were assessed using a confidence scale ranging from 0 per cent (*Not at all confident*) to 100 per cent (*Extremely confident*). The mean for all 9 items was computed for each participant and used in the analyses. Excellent internal consistency was evident for this measure (Cronbach’s alpha = .97; Tabachnick & Fidell, 2007).

Anticipated persistence with problem-solving. Participants’ anticipated persistence to *find solutions to specific problems* by engaging in the three steps of the problem-solving process was assessed using the same four-item measure that was used to assess anticipated persistence in Study 1A. The measure was adapted for finding solutions to specific problems by engaging in

the three steps of the problem-solving process. Participants were first reminded of the three steps in the problem-solving process (define the problem, generate possible solutions, select a solution to implement), which are used to find solutions to specific problems. They were reminded that the goal of these steps is to identify a solution plan, but not to implement the solution. These items were developed based on descriptions of the framework presented by Chang, D’Zurilla, and Sanna (2004). Participants were then asked to rate how much (1) time and (2) attention they were willing to put forth, (3) how much they were willing to persist with the 3 steps to identify a solution plan, and (4) how much attention they were willing to direct with respect to the 3 steps of PS to identify a solution plan that could be carried out. An example item is, “How much effort are you willing to put forth in order to engage in the 3 steps of problem solving to identify a solution plan that could be carried out?”. Participants responded on a 1(*little to none*) to 9 (*as much as it takes*) scale. The mean for all 4 items was computed for each participant and used in the analyses. Excellent internal consistency was evident for this measure (Cronbach’s alpha = .94; Tabachnick & Fidell, 2007).

Self-efficacy for solution implementation (SESI). Participants assessed their confidence in their ability for *carrying out* their solution using a 4-item measure. Participants were first asked to identify a solution to the problem and then to assess their confidence to carry out the solution. These items were developed based on descriptions of the framework presented by Chang, D’Zurilla, and Sanna (2004) and also followed recommendations for measuring self-efficacy. The stem and items are outlined here: “Once you have identified a solution to the problem, how confident are you that you can”: (1) Predict the outcomes of your attempt on your solution (i.e., the likelihood that you will successfully solve the problem), (2) Carry out the solution as planned with few errors, (3) Evaluate the success of your attempted solution, and (4)

Troubleshoot to improve future attempts. Items were assessed using a confidence scale ranging from 0 per cent (*Not at all confident*) to 100 per cent (*Extremely confident*). The mean for all 4 items was computed for each participant and used in the analyses. There was excellent internal consistency for this measure (Cronbach's alpha = .95; Tabachnick & Fidell, 2007).

Anticipated persistence with solution implementation. Participants' anticipated persistence for *carrying out their solution* was reported using the same 4-item measure that was used to assess anticipated persistence in Study 1A. The measure was adapted for carrying out solutions. These items were developed based on descriptions of the framework presented by Chang, D'Zurilla, and Sanna (2004). Participants were first asked to identify a solution to the problem and then to rate how much (1) time and (2) effort they were willing to put forth, (3) how much they were willing to persist with the plan, and (4) how much attention they were willing to direct toward carrying out the solution. An example item is, "How much effort are you willing to put forth in order to carry out this solution?". Participants responded on a 1(*little to none*) to 9(*as much as it takes*) scale. The mean for all 4 items was computed for each participant and used in the analyses. Excellent internal consistency was reported for this measure (Cronbach's alpha = .98; Tabachnick & Fidell, 2007).

Problem-solving effectiveness (PSE). The Social Problem Solving Inventory-Revised (SPSI-R) was used to assess problem-solving effectiveness. The theory-based long version of the SPSI-R (D'Zurilla, Nezu, & Maydeu-Olivares, 2002) is a 52-item measure. Some example items include, "When I have a problem, I try to see it as a challenge, or opportunity to benefit in some positive way from having the problem" (positive problem orientation) and "I wait to see if a problem will resolve itself first, before trying to solve it" (avoidant problem-solving style).

Items were assessed on a 0 (*not at all true of me*) to 4 (*extremely true of me*) scale and the total PSE score was out of 20 based upon weighting that included the 5 dimensions of MSPS. The SPSP-R has sufficient internal consistency, with alpha coefficients ranging from .79 to .95 across five scales, and excellent test-retest reliability, with correlation coefficients ranging between .89 and .93 for the total score over a 30-week period among two different samples. In the current study, the mean internal consistency of five scales was acceptable (Cronbach's alpha = .77; Tabachnick & Fidell, 2007).

Problem check and message quality checks. These measures were used to verify that the stimulus material was actually perceived by participants to be a problem, and that the quality of the written message was high.

Problem check. Participants responded to 1 item to indicate the extent to which they perceive the problem scenario to be stressful. This item was used to confirm that the scenario presented a problem that was perceived to be challenging. This item was scored on a scale of 1 (*not stressful at all*) to 9 (*extremely stressful*). The degree of the challenge was assessed based on the level of stress that it presented, so as to address not only the challenge, but also the feelings associated with the it.

Message quality checks. The quality of the message was assessed using 6 items. Participants responded on scale of 1 (*strongly disagree*) to 9 (*strongly agree*) to give their impressions about the scenario. Items were as follows: "The person in the problem scenario could be someone like me", "The problem scenario was believable", "The problem scenario was easy to read", "The problem scenario was understandable", "I could easily place myself in this situation", and "The situation described was realistic". Consistent with other published scenario-

based research in exercise in which message quality checks were used to assess the overall message (i.e., Priebe, Flora, Ferguson & Anderson, 2012; Strachan, Flora, Brawley, & Spink, 2011), a mean score was computed for message quality. Good internal consistency was reported for these items (Cronbach's $\alpha = .89$; Tabachnick & Fidell, 2007).

Stimulus Material

The stimulus material was a written scenario that described a highly relevant exercise-related problem and was specifically developed for CR initiates. Participants were asked to place themselves in the situation described. The scenario presented a salient problem to which each reader who fit the inclusion criteria could relate. The scenario described that in addition to their numerous, but manageable activities (i.e., CR exercise), interests (i.e., volunteering) and responsibilities (i.e., regular family life, helping a friend after their surgery), an unexpected task arises in which they are interested and that they value (i.e., attending sessions with a grandchild at school), but which directly conflicts with their CR exercise time. Participants were expected to persist with this problem for at least the next four weeks, and were required to engage in some decision-making relative to the task and attending their CR exercise sessions. They were informed that the questions that follow would relate to how they would react if they were in this participant-relevant situation. See Appendix G for stimulus material.

Stimulus material development and pilot testing. In accordance with the problem-solving literature, the scenario was constructed to include a circumstance that demands responses for adaptive functioning, and also includes various obstacles related to ambiguity, uncertainty, conflicting demands and lack of resources, which are identified obstacles that may lead to a problem (Cormier, Otani & Cormier, 1986). Prior to the main study, focus groups were

conducted with CR patients ($N = 5$) who had graduated from the entry-level component of the program and were continuing to attend CR exercise. These experienced participants were presented with the problem scenario and asked to respond to questions about the content and provide suggestions about common demands experienced by CR patients, particularly when starting CR. Participants completed problem checks to indicate that (1) the problem scenario was potentially a problem, (2) the problem scenario was recognized as a potential problem, (3) a wide range of solutions with varying degrees of effectiveness could be generated, (4) a response was needed for adaptive functioning, (5) the problem can be solved, and (6) the most effective solution is not available or apparent immediately. Suggestions were used to enhance the stimulus material prior to its use in the main study. All descriptions that follow are related to the main study only.

Procedure

Assessments. Participants received an envelope containing the study consent and assessment package. The survey package contained all study measures. Participants were instructed to complete these in the order presented as follows. Participants first completed demographics, baseline SRE-CR, and PSE (SPSI-R) measures. Next they read the stimulus material and completed post-problem SRE-CR, persistence with CR, SEPS, persistence with PS, SESI, persistence with SI measures, as well as the problem check and message quality checks. All surveys were completed outside of CR to prevent participants being directly influenced by any aspect of the program. Participants were instructed that all responses should be completed at home on their own and they were asked to confirm this on the final page of the survey package by providing their signature to indicate their commitment to this. All participants received five

dollars for completing the survey and had their names entered into a draw for \$50 a gift certificate.

Analytic Plan

To examine the first set of hypotheses (hypotheses 1 to 3), separate regression analyses were conducted to examine the SCT-based relationships between (1) Self-regulatory efficacy for CR exercise (SRE-CR) and anticipated persistence with CR (2) Self-efficacy for problem-solving (SEPS) and anticipated persistence with problem-solving, and (3) Self-efficacy for solution implementation (SESI) and anticipated persistence with solution implementation. In each model, self-efficacy was the predictor variable and anticipated persistence was the dependent variable. To examine the second set of hypotheses (hypotheses 4 to 9), separate regression analyses were conducted to examine the SPS model-based relationships between problem-solving effectiveness and (4) SRE-CR, (5) anticipated persistence with CR exercise, (6) SEPS, (7) anticipated persistence with PS, (8) SESI, and (9) anticipated persistence with SI. In each model, problem-solving was the independent variable and self-efficacy and anticipated persistence were the dependent variables. To examine the final hypothesis (hypothesis 10), a MANOVA was conducted to examine differences between more and less effective problem-solvers on self-efficacy and anticipated persistence relative to CR exercise, PS, and SI. Consistent with past practice in the psychological literature (Bond et al., 2003; Elliott & Marmarosh, 1994), more and less effective problem-solvers were identified by a median split of the problem-solving effectiveness score, as measured by the SPSI-R.

Results

Data Management

Data management strategies were employed to address missing data and the presence of outliers. All steps were in accordance with recommendations made by Tabachnick and Fidell (2007). A brief description is provided here, as a complete overview of data management strategies employed for all studies in the dissertation is available in Study 1A.

Missing data. When one item was missing from a scale, the mean for the remaining items in that subscale was used to replace the missing value. For example, three participants were missing one item each and two participants were missing two items each in the PSE measure. One participant was missing 4 items in the PSE measure, although no more than one item was missing from any particular subscale. Two participants were missing one item each on the SESI measure. In each of these examples, the mean for the answered items in the subscale were used to replace the missing values, as recommended by Tabachnick and Fidell (2007). When all items for a given scale were missing, the sample mean for each item was used to replace the missing scores.

Outliers. Outliers were identified using standardized scores using the recommended benchmark of a standardized score greater than 3.29 ($p < .001$) to indicate extreme cases. Data from two participants were adjusted due to outlying standardized scores. In accordance with recommendations, scores on the variables for outlying cases were changed to be less deviant by changing raw scores to within one unit of the next most extreme score in the distribution.

Descriptive Statistics

Descriptive data. Participants' mean scores and standard deviations for study variables are presented in Table 7. Correlations between main study variables are available in Appendix H.

Table 7

Means for All Study Variables Grouped by Problem-Solving Effectiveness

	More Effective Problem-Solvers (<i>n</i> = 26)		Less Effective Problem-Solvers (<i>n</i> = 26)		Totals (<i>n</i> = 52)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS Effectiveness**	14.64	1.36	10.72	1.28	12.68	2.37
SRE for CR Exercise *	79.62	14.01	67.93	20.00	73.77	18.07
Anticipated Persistence with CR Exercise*	8.19	1.33	7.32	1.51	7.75	1.48
Self-Efficacy for PS**	84.26	9.50	63.34	16.38	73.80	16.95
Anticipated Persistence with PS**	8.01	0.98	6.63	1.13	7.32	1.26
Self-Efficacy for SI**	81.91	10.20	63.72	23.33	72.82	20.05
Anticipated Persistence with SI**	8.26	1.22	6.62	1.97	7.44	1.82

Note. * Denotes significant between-group differences, $p < .05$; ** Denotes between-group differences, $p < .001$. Abbreviations: SRE is self-regulatory efficacy, PS is problem-solving, SI is solution implementation. Scale range for variables is as follows: Problem-solving effectiveness (0-20); SRE (0-100); Anticipated persistence (1-9). Group differences between more and less effective problem-solvers on overall PS effectiveness scores were confirmed with a *t*-test, $t(50) = 10.7$, $p < .001$.

Relationships between adherence-related social cognitions. Assumptions of multiple regression (ratio of cases to independent variables, outliers, multicollinearity and singularity of independent variables, normality, linearity, homoscedasticity and independence of residuals) were checked and determined to be non-problematic.

Relative to the first set of hypotheses (hypotheses 1 to 3), separate regressions indicate that self-efficacy is significantly and positively related to anticipated persistence relative to CR exercise, PS, and SI (hypotheses 1 to 3 supported). These findings are consistent with the agency tenets of social cognitive theory, p 's < .001. $R^2_{adjusted}$ for these regressions are reported in Table 8.

Problem-solving predicting self-efficacy and persistence. Relative to the second set of hypotheses (hypotheses 4 to 9), separate regressions were conducted. They revealed that PS effectiveness was not significantly related to SRE-CR and anticipated persistence with CR, p 's > .05 (hypotheses 4 and 5 not supported).

PSE was significantly related to SEPS and to anticipated persistence with PS, p < .001 (hypotheses 6 and 7 supported). PSE was also significantly related to SESI and anticipated persistence with SI, p < .001 (hypotheses 8 and 9 supported). $R^2_{adjusted}$ for these regressions are reported in Table 9.

Differences in social cognitions as a function of problem-solving effectiveness. Prior to the MANOVA being conducted, group differences between more and less effective problem-solvers on overall PSE scores were empirically verified with a t -test, $t(50) = 10.7$, p < .001.

Testing of assumptions. Assumptions of a MANOVA were examined. Box's test of equality of covariance matrices was significant indicating a violation of the assumption of homogeneity of covariances. Levene's test was significant, indicating that the assumption of homogeneity of variance was violated for SRE-CR, SEPS, SESI, and anticipated persistence with SI. Given that assumptions were violated, data were examined for indicators of non-normality and these variables were found to be skewed. Square root, log and inverse

transformations were applied, but skewness was not further reduced by these steps. Therefore, for ease of interpretation, raw data was used for the analysis and is presented here.

Consistent with hypothesis 10, results of a MANOVA revealed a significant between-groups multivariate effect of PSE on SRE-CR, persistence with CR exercise, SEPS, persistence with PS, SESI, and persistence with SI, $F(6, 45) = 7.0$, $Wilks' \lambda = .52$, $p < .001$, $partial \eta^2 = .48$, indicating a medium size multivariate effect. Separate follow-up univariate ANOVA's revealed significant differences on all variables, p 's $< .05$, $partial \eta^2$'s range from .09 to .39, indicating small to medium effects, with more effective problem-solvers reporting higher scores on all exercise-related social cognitions (hypothesis 10 supported). In order to guard against Type 1 error, a Bonferroni correction was applied (Cohen, 1990). Six familywise tests at $p < .05$ would be interpreted at $p = .008$. Group differences remained significant for SEPS, persistence with PS, SESI, and persistence with SI, but not for SRE-CR and persistence with CR exercise at this adjusted alpha.

Table 8

Social Cognitive Theory-Based Relationships

Predictor	Exercise-Related Social Cognitions as Criterion		
	<i>R² Adjusted</i>		
	Anticipated Persistence with CR Exercise	Anticipated Persistence with PS	Anticipated Persistence with SI
Self-Efficacy	.47*	.39*	.47*

Note. $N = 52$; * $p \leq .001$. All values are for separate regressions.

Table 9

Social Problem-Solving Model-Based Relationships

Predictor	Exercise-Related Social Cognitions as Criterion <i>R² Adjusted</i>					
	Self-Regulatory Efficacy for CR Exercise	Anticipated Persistence with CR Exercise	Self-Efficacy for Problem-Solving	Anticipated Persistence with PS	Self-Efficacy for Solution Implementation	Anticipated Persistence with SI
PS Effectiveness	.05	.04	.38*	.28*	.19*	.20*
Total score						

Note. $N = 52$. $*p \leq .001$. All values are for separate regressions. Six familywise tests at $p < .05 = .008$ (Cohen, 1990)

Problem check and message quality checks. Mean score of 4.96 ($SD = 2.21$) on a 1 to 9 scale indicate that participants perceived the scenario to be moderately stressful. Message quality checks are reported as a mean score of the six items used to assess message quality. Mean scores of 7.38 ($SD = 1.46$) on a 1 to 9 scale indicate relatively strong agreement with characteristics of the message quality (i.e., it was realistic, relevant, easy to read, and participants could place themselves in the situation described, etc).

Post hoc Analyses

Findings revealed that all relationships hypothesized by each model were supported, with the exception of hypotheses 4 and 5 examining problem-solving effectiveness as a predictor of SRE-CR and persistence with CR. In view of these results, one speculation is that some of these relationships may operate in an additive fashion to predict anticipated persistence. Therefore, a follow-up analysis was conducted.

Using the theoretical frameworks as a guide, a hierarchical multiple regression was used to determine if both problem-solving effectiveness and self-efficacy predicted anticipated persistence with CR exercise. Problem-solving effectiveness was entered as the predictor in step 1, on the bases that it is the more global measure of psychological approach toward problems. Self-efficacy, as the more specific situational belief about upcoming weeks of exercise in the face of challenges was entered as the predictor in step 2, and the dependent (criterion) variable was anticipated persistence with exercise during the upcoming weeks. In accordance with previous analyses, these relationships were examined relative to (1) CR exercise, (2) PS, and (3) SI.

Relative to predicting *CR exercise*, the total model was significant $R^2_{adjusted} = .46$. In this model, problem-solving effectiveness was not a significant predictor of anticipated persistence with CR exercise ($p > .05$). SRE-CR alone was significant, accounting for 40 per cent of the variance in anticipated persistence with CR exercise, $p < .001$.

Relative to *problem-solving* (PS), findings indicate that both predictors contributed significantly to the prediction of anticipated persistence with PS. As expected, problem-solving effectiveness was a significant predictor, accounting for 29 per cent of the variance in anticipated persistence with PS, $p < .001$. SEPS accounted for an additional 14 per cent of the variance in anticipated persistence with PS, $p = .001$, and the total model $R^2_{adjusted} = .41$.

Finally, relative to *solution implementation* (SI), PS effectiveness was a significant predictor, accounting for 21 per cent of the variance in anticipated persistence with SI, $p = .001$. SESI accounted for an additional 29 per cent of the variance in anticipated persistence with SI, $p < .001$, and the total model $R^2_{adjusted} = .49$.

In the models relative to PS and SI, as expected, problem-solving effectiveness was a significant predictor of anticipated persistence. However, in each model, the predictive capability of problem-solving effectiveness was reduced when self-efficacy was entered into the model in step 2, as reflected by the lower contribution of problem-solving effectiveness in the final model. This finding may, in part, be due to issues related to correspondence of measures. For example, the self-efficacy and anticipated persistence measures were both assessed relative to the specific problem described in the written scenario, thereby reflecting greater correspondence between these measures. Conversely, the PS measure was a global indicant of ability to generally solve problems without specified context, and would have been less correspondent with the specific measure of anticipated persistence. R^2 , R^2 change, and standardized beta coefficients are reported in Tables 10a, 10b and 10c

Table 10a

Predictors of Anticipated Persistence with CR Exercise

Predictor	Anticipated Persistence with CR Exercise		
	R^2	$R^2\Delta$	β
Step 1		.05	
PS effectiveness			.23
Step 2	.48	.43*	
PS effectiveness			.06
SRE-CR			.67*
Total model $R^2_{adjusted}$.47*		

Note. $N = 52$. * $p \leq .001$.

Table 10b

Predictors of Anticipated Persistence with Problem-Solving

Predictor	Anticipated Persistence with Problem-Solving		
	R^2	$R^2\Delta$	β
Step 1		.29*	
PS effectiveness			.54*
Step 2	.43	.14*	
PS effectiveness			.24
Self-Efficacy for PS			.48*
Total model $R^2_{adjusted}$.41*		

Note. $N = 52$. * $p \leq .001$.

Table 10c

Predictors of Anticipated Persistence with Solution Implementation

Predictor	Anticipated Persistence with Solution Implementation		
	R^2	$R^2\Delta$	β
Step 1		.21*	
PS effectiveness			.46*
Step 2	.51	.29*	
PS effectiveness			.19
Self-efficacy for SI			.61*
Total model $R^2_{adjusted}$.49*		

Note. $N = 52$. * $p \leq .001$.

Discussion

Theoretical relationships proposed by Model of Social Problem-Solving (MSPS) and Social Cognitive Theory (SCT) were examined relative to CR exercise and PS process. Relative to PS process, both problem-solving (PS) and solution implementation (SI) components of the PS process were investigated. The study findings support relationships proposed by SCT and the relationships proposed by MSPS, with the exception of findings relative to CR exercise, which

were not significant. Non-significant findings may be a function of a lack of correspondence between measures. For example, correspondence between problem-solving effectiveness and (a) SRE-CR and (b) persistence with CR exercise measures was weaker than the direct correspondence between problem-solving effectiveness and measures of social cognitions relative to the problem-solving process (SEPS, anticipated persistence with PS, SESI, and anticipated persistence with SI).

The SCT-based relationship between the social cognitions, self-efficacy and anticipated persistence were confirmed. A significant relationship was demonstrated between problem-solving effectiveness and social cognitions relative to PS process (SE and anticipated persistence for PS and SI). Consistent with recommendations made by D’Zurilla and Nezu (2007), both PS and SI components of the PS process were examined separately in this study, addressing an important theoretical distinction made in the problem-solving literature.

Findings about differences as a function of problem-solving effectiveness (hypothesis 10) support MSPS tenets and suggest a potential advantage for individuals with more effective problem-solving. These individuals reported higher scores on self-efficacy and persistence for finding solutions and carrying out solutions relative to a problem (small to medium effect sizes). Higher scores on these social cognitions may suggest a motivational advantage with respect to persisting to find solutions to problems. Results relative to CR exercise, while not significant, were also in the expected direction, with more effective problem-solvers reporting higher self-regulatory efficacy for CR exercise and stronger anticipated persistence for CR exercise (η^2 's = .11 and .09). Relative to exercise-related problems, the support for hypotheses 6 through 9 suggests that more effective problem-solvers may also display more adaptive social cognitions associated with greater effort and persistence relative to seeking solutions to problems. The

potential benefits of these social cognitions in an exercise setting relative to managing lapses as problems, however, are yet to be explored.

This study's focus on the examination of aspects of problem-solving process is important as it addresses a gap identified in the problem-solving literature. Ewart (1990) stated that examination of the problem-solving process is seldom undertaken, yet this research is critical in order to develop an understanding about *how* or *why* problem-solving improves adherence to exercise in cardiac rehabilitation. Building on findings from this study, future studies using a prospective research design are recommended. Such investigations may have the potential to confirm that the variables identified in this study are prospectively linked to steps in the problem-solving process. For example, a prospective research design would enable an examination of a potential mediating role of the process variables examined in this study (self-efficacy for and persistence with PS process), relative to the relationship between problem-solving and exercise adherence.

Much of the extant research in the problem-solving literature addresses problem-solving deficiencies, attempting to improve problem-solving effectiveness among samples with poor problem-solving abilities. While there is no current benchmark for problem-solving deficiencies to guide interpretation of problem-solving effectiveness scores, the sample in the present study reported a problem-solving effectiveness mean of 12.68, which is above the midpoint of a possible score out of 20. Interestingly, between-group differences in self-efficacy and anticipated persistence were observed despite means for problem-solving effectiveness for both groups were above the midpoint (higher PSE =14.6 and lower PSE = 10.7). Considering these differences, it might be interesting to examine the potential for improving problem-solving

effectiveness of both groups and exploring possible advantages associated with any improvements.

This raises an interesting question about possible targets for problem-solving interventions. For example, while problem-solving tend to target individuals with problem-solving deficiencies, there may be potential benefits of a problem-solving training intervention for individuals with a range of problem-solving abilities (i.e., not just very low abilities). It may be that even small improvements in problem-solving abilities may be associated with positive outcomes (i.e., improved adherence and fewer lapses).

This study is the first to focus upon theory-based relationships relative to CR exercise and PS process among initiate participants enrolled in CR. This is an important gap identified in the PS literature. Ewart (1990) discussed the potential importance of problem-solving in assisting CR patients with managing numerous health challenges, including regular exercise, and called for more problem-solving research among individuals with coronary heart disease. He emphasized the importance of problem-solving in adherence research and noted that problem-solving is under-examined in this area. Examining problem-solving in the CR population has been an ongoing suggestion in the problem-solving literature (e.g., Chang, D'Zurilla, & Sanna, 2004; D'Zurilla & Nezu, 2007), however, for more than 20 years, this recommendation seems to have gone unheeded. The present study addressed these identified needs, offering preliminary findings to address the longstanding call for more research.

Strengths and Limitations

One of the key strengths of this research is the strong theoretical foundations. Specifically, theoretical relationships proposed by several frameworks were examined in the context of CR interventions (SCT, Bandura, 1997; MSPS, D'Zurilla, Nezu, & Maydeu-Olivares,

2002; Ewart, 1990). Health behaviour change literature has highlighted the importance of testing theories and drawing on these findings to develop theory-based interventions (Painter et al., 2008). The current study attended to the Painter et al. recommendation by examining theoretical relationships proposed by SCT and MSPS in the context of participants engaged in CR programs designed to promote exercise therapy and reduce cardiovascular risk.

Another study strength was the carefully constructed stimulus material that was developed through pilot work with individuals who were similar to the study sample and could provide insight about realistic problems for this population. Given a real lapse as a problem cannot be manipulated with CR participants for obvious ethical reasons, construction of a realistic problem common for all participants, was an important methodological step for this initial study. This pilot work and methodological step was taken to assure that the problem scenario would be salient and relevant to the study sample. As well, the scenario problem was perceived to be at least moderately stressful. The quality of the stimulus material was also confirmed using message quality checks. Furthermore, checks were also employed during the stimulus development stage to assure that the problem scenario contained important characteristics of a problem, as informed by past PS literature.

Every study also has limitations and this preliminary investigation is no exception. The primary limitation of this study is that this study employed convenience sampling, thereby limiting the generalizability of the findings to CR initiates in the three CR programs from which they were recruited. All participants were regularly participating in the structured exercise therapy associated with these CR programs. Findings may not extend to other CR programs or samples that are not involved in regular exercise.

A note is warranted about the sample size, which is acknowledged to be small. It is reasonable to expect that recruitment for research among samples with chronic conditions might be more challenging than for healthy samples, given potentially smaller pools of available volunteers. However, considering the recommendations for problem-solving research within cardiac samples, a smaller sample size was a reasonable trade-off for the opportunity to investigate these research questions within this particular sample of interest.

Finally, it is important to note that while not considered to be a limitation, several of the social cognitive measures associated with each component of the problem-solving process were developed for this study (e.g., SEPS, anticipated persistence with PS, SESI, anticipated persistence with SI). While care was taken to develop these measures in accordance with recommendations from the problem-solving literature and guidelines for developing measures of self-efficacy (Chang, D’Zurilla, and Sanna, 2004; McAuley & Mihalko, 1998), the reader is cautioned that these measures were used for the first time and further use is required in problem-solving research relative to exercise and CR.

Future Directions

Future research could explore whether specific dimensions of problem-solving effectiveness (i.e., constructive and dysfunctional) are moderators of adherence or of resuming exercise after an adherence relapse. Further, research distinguishing the potential contribution of specific dimensions could have implications for the content and delivery of problem-solving interventions. For example, if rational problem-solving style is found to be more strongly associated with adherence, this knowledge may provide the opportunity to offer condensed problem-solving training that focuses on this dimension.

A second line of investigation that should eventually develop after preliminary studies is the potential mediating role of problem-solving process in adjustment to problems related to rehabilitative exercise. Specifically, the mediating role of process variables examined in this study (SEPS, anticipated persistence with PS, SESI, anticipated persistence with SI) could be examined relative to adjustment following problem-solving therapy in which problem-solving processes (PS and SI) are targeted. In this design, problem-solving therapy could be compared to a control group to improve adherence or action on behaviours for solutions. Therefore, the process variables mentioned could be mediator(s) of the relationship between treatment and outcomes.

Finally, the relationships examined in study 2 could be examined in other rehabilitative settings, where exercise is used for rehabilitative purposes, for example, in a cancer population. To investigate this, Study Three investigates some of these questions in a sample of cancer survivors.

STUDY 3: EXAMINING THE RELATIONSHIP BETWEEN SOCIAL PROBLEM-SOLVING AND EXERCISE SOCIAL COGNITIONS AMONG ACTIVE CANCER SURVIVORS.

Exercise and Self-Management of Cancer-Related Fatigue

According to a recent meta-analysis in the *Annals of Behavioral Medicine*, exercise is related to positive outcomes among cancer survivors (Ferrer, Huedo-Medina, Johnson, Ryan, & Pescatello, 2011). Regular exercise participation among individuals with cancer is associated with maintenance of functional ability, prevention of comorbidities, and reduction of the risk of death from causes other than cancer (Brown et al., 2003; Vallance, Courneya, Jones & Reiman, 2005). However, there are numerous challenges associated with cancer that can make exercising difficult. For example, a common problem or barrier to exercise among cancer survivors is cancer-related fatigue, a symptom reportedly experienced by all individuals with cancer (Curt et al., 2000; Schultz, Klein, Beck, Stava, & Sellin, 2005). While research suggests that exercise may reduce cancer-related fatigue (Kirshbaum, 2006; Mock et al., 2005), adherence to regular exercise is a challenge, particularly when individuals are undergoing, or have recently completed treatment. Lapses in exercise resulting from these challenges may prevent individuals from realizing benefits associated with regular exercise.

The use of cognitive-behavioural strategies is associated with physical activity behaviour change among symptomatic populations, generally (e.g., Artinian et al., 2010), and exercise-related social cognitions have been shown to be associated with exercise behaviour among cancer survivors, specifically (Loprinzi, Cardinal, Si, Bennett, & Winters-Stone, 2012). Problem-solving (PS) is one cognitive-behavioural strategy that has been acknowledged in the exercise literature for its role in rehabilitation and disease self-management. In the problem-

solving therapy (PST) literature, it has also been implicated as a prevention strategy to reduce the risk of health problems (D’Zurilla & Nezu, 2007). PS has been acknowledged by the American Heart Association and the Canadian Association of Cardiac Rehabilitation to be an important strategy for the management of lapses in exercise, and has been linked to exercise adherence (Artinian et al., 2010; Ewart, 1990; Prior, Francis, Reitav & Stone, 2009). While PS has not specifically been studied among cancer survivors relative to its impact on exercise adherence, studies have examined PS in the cancer population relative to managing challenges commonly faced by this population, (e.g., emotional distress). Studies have also investigated the use of PS therapy to improve coping ability and quality of life among cancer survivors (Nezu, Nezu, Friedman, Faddis & Hauts, 1998). Current evidence indicates that PS therapy is associated with reduced distress in cancer survivors and suggests that effects may be linked to PS ability (D’Zurilla & Nezu, 2007). Considering the research in other symptomatic samples illustrating that PS is an important self-regulatory strategy to include in exercise interventions, (e.g., Artinian et al., 2010), it is conceivable that PS may also be linked to exercise adherence among cancer survivors. However, to date, investigation of PS and exercise has not been undertaken for this population.

Research Needs in Problem-Solving

To investigate PS relative to self-regulating exercise and managing problems among special populations, recommendations and research needs were drawn from other aspects of the PS literature that focused on individuals with disease-related problems (D’Zurilla & Nezu; Chang, Downey & Salata, 2004).

Identifying correlates of exercise self-regulation and PS was deemed to be an important first step in contributing to needs identified by PS researchers focused on symptomatic populations. Key exercise correlates of PS and exercise in cancer survivors with cancer-related fatigue include those specified by theory and past research in exercise. In the present study, self-regulatory efficacy, persistence, decisional struggle as well as disease-related factors that affect exercise such as the perception of fatigue and fatigue acceptance are examined. A brief description is provided to clarify the relevance of these correlates in terms of how they are related to PS and other social cognitions.

Social Cognitive Correlates of Exercise Behaviour and the Problem-Solving Process

Self-regulatory efficacy and persistence. According to Bandura's Social Cognitive Theory (SCT; 1986), in the face of a challenge, individuals' self-regulatory efficacy (SRE) beliefs predict how much they will persist through challenges, and both SRE and persistence influence one's capacity for and effectiveness in self-regulation. There is ample research to support these theory-based relationships in exercise (e.g., Glazebrook & Brawley, 2011; Gyurcsik, Brawley, Spink, Glazebrook, & Anderson, 2011; Jung & Brawley, 2011).

Preliminary investigation of the relationship between PS and these well-investigated exercise social-cognitions is promising, revealing that PS effectiveness is related to SRE for exercise and persistence with exercise. This was demonstrated in Study 2 of this dissertation in a sample of cardiac rehabilitation initiates who were faced with an exercise lapse-related problem. Similarly, PS effectiveness is expected to be related to SRE and persistence among cancer survivors who are challenged by cancer-related fatigue. This expectation is in accordance with tenets of the Model of Social Problem-Solving, which suggests that in the face of a challenge,

more effective problem-solvers will have better outcomes than less effective problem-solvers (D'Zurilla, Nezu, & Maydeu-Olivares, 2002). This has yet to be examined among an exercising sample of individuals managing cancer-related fatigue, where this fatigue is cited to be a major barrier to exercise.

Decisional struggle. The extent to which people struggle with decisions may be an indicator of cognitive rumination. Decisional struggle is associated with positive and negative thoughts that an individual may experience during a perceived challenging situation in which a decision is required. Previous exercise research demonstrates that acute positive and negative thoughts are related to decisional struggle and exercise self-regulatory efficacy (See Gyurcsik & Brawley, 2001; Kendzierski & Johnson, 1993), and ultimately, measures of adherence. Within the investigation of PS and exercise among cancer survivors with cancer-related fatigue, more effective problem-solvers are expected to struggle less with their decision to exercise in the face of a challenge, and not be impeded by ruminative thinking, as compared to less effective problem-solvers.

Perceived fatigue and fatigue acceptance. The literature on exercise and arthritis pain management illustrates that varying levels of pain acceptance differentiate exercise-related social cognitions important for exercise adherence among active women with arthritis (Gyurcsik et al., 2011). Similarly, in this study of exercise among cancer survivors, the fatigue experience may be an important disease-related factor or problem that affects exercise adherence. Therefore, in examining their exercise, it is important to consider the perceived fatigue reported by cancer survivors, as well as their acceptance of that fatigue.

Examining problem-solving and aspects of process. Problem-solving is identified to be an important cognitive-behavioural strategy linked to exercise adherence. While evidence suggests that PS is an important component of multi-component cognitive-behavioural change interventions, little is understood about how PS may be linked to exercise adherence (e.g., whether PS is a correlate, cause, or moderator of exercise adherence). This examination of aspects of process is frequently a missing link in physical activity intervention research.

Andersen (1992) noted there is a paucity of cancer research that examines process components of interventions. Unfortunately, one decade later, she noted that the examination of process remains an unfilled gap (Andersen 2002), further underscoring the need to address the question pertaining to how intervention outcomes are achieved. Examples of unaddressed questions include the following: How does better PS lead to reduced distress among cancer survivors? Why are better problem-solvers able to self-manage challenges and be more adaptive in the face of challenges associated with recovering from cancer? Relative to exercise interventions, while the links between PS, social-cognitive correlates of behaviour, and exercise adherence have been proposed, there is little indication if the single strategy of PS is linked to correlates of adherence. It was the general purpose of this third study to identify initial relationships that would inform questions that would begin to address some of the gaps identified by Andersen and others.

Two theoretical frameworks were used to guide this third study, The Model of Social Problem-Solving (MSPS; D'Zurilla, Nezu, & Maydeu-Olivares, 2002; Ewart, 1990) and the agency aspect of Social Cognitive Theory (SCT; Bandura, 1986). It is important to understand the basic propositions of the models relative to circumstances that demand that individuals deal

with a challenging problem. To illustrate, SCT posits that self-regulatory efficacy (SRE) beliefs predict one's persistence in the face of a challenge, and that both variables are important in motivating and regulating consistent behaviour. MSPS posits that PS effectiveness is associated with better adaptation to problems. According to this model, when faced with a problem, more effective problem-solvers would produce better solutions and have better outcomes than their less effective counterparts. In discussing the regulation of cardiac rehabilitation behaviour, Ewart (1990) argued that continued PS activities would be associated with greater persistence in the face of a challenge. Tenets of MSPS and SCT may also suggest that more effective problem-solvers would exhibit less rumination and less decisional struggle related to their decision to exercise in the face of a challenge (Maddux & Lewis, 1995). Based on these suggestions and exercise research in both asymptomatic and symptomatic populations (i.e., Jung & Brawley, 2011; Gyurcsik & Brawley, 2000), it is expected that when faced with a challenge or a problem related to their exercise, more effective problem-solvers would exhibit higher self-regulatory efficacy for exercise, report greater anticipated persistence with exercise, and less decisional struggle relative to their decision to exercise.

Problem-Solving and Positive Psychological Functioning

Whereas the focus of general PS research identified in earlier sections has been on psychological dysfunction such as emotional distress, PS is also thought to elicit positive psychological outcomes. It is not only the pursuit of reducing or repairing negative qualities that is important, but from a positive psychology viewpoint it is also the pursuit of increasing or building positive qualities (Chang, Downey, & Salata, 2004).

Research is needed to understand the possible positive result of individuals executing PS beyond the potential benefits of adherence. Are there associations between PS and positive psychological functioning (PPF)? The existing limited research findings relative to PPF, are promising, but more research is needed (see Seligman and Csikszentmihalyi, 2000). One of the primary indicators of PPF examined in extant research is psychological well-being. The next section describes this indicator as well as some important gaps relative to its use in the PS literature.

Psychological well-being (PWB). Ryff's multidimensional model of PWB (1989; 1995) describes six dimensions of PWB: self-acceptance; positive relations; autonomy; environmental mastery; purpose in life; and personal growth. The Scales of Psychological Well-Being (Ryff, 1989) used to examine PWB are based on this six-dimension model. Existing research on PS and PWB supports tenets of MSPS (D'Zurilla et al., 2002). Significant positive associations between positive problem orientation and PWB, and significant negative associations between negative problem orientation and PWB have been observed (cf. Chang et al., 2004). However, it is important to note that much of the extant research was conducted with college student samples and asymptomatic middle-aged adults. Recognizing the limited generalizability of existing research, Chang and colleagues call for more PS and PWB research in different populations. Furthermore, while there is initial evidence linking PS to PWB (Chang, D'Zurilla, Sanna, 2007), none examines PS and PWB among cancer survivors relative to exercise. Additionally, Chang and colleagues note the importance of examining potentially important correlates of PPF such as self-efficacy as well as further examining how MSPS tenets relate to other positive psychological variables.

To begin to address these gaps, as well as explore other indicators of PPF, the current study examined psychological well-being and rumination relative to problem-solving among exercising cancer survivors. The next section describes rumination and its importance relative to positive psychological functioning.

Rumination. Rumination refers to repetitive thought, pondering or meditating on information. The distinction between intrusive and deliberate rumination is an important one. Intrusive ruminations are unsolicited invasions of one's cognitive world, and include thoughts about an experience that one does not choose to bring to mind. Conversely, deliberate ruminations are voluntary and can be focused purposefully on trying to understand events and their implications. Rumination has acquired a negative connotation in the clinical literature where it is typically defined as negative self-focused thinking and closely resembles intrusive rumination (see Cann et al., 2011). For example, a review by Soo, Burney, and Basten (2009) examined rumination relative to illness focusing only on maladaptive ruminative cognitions. However, it has been argued that ruminative thoughts are not exclusively maladaptive, but may also serve adaptive functions, for example, in the form of controlled thoughts focused on making sense of an experience (Martin & Tesser, 1996; Watkins, 2008). This type of adaptive recurrent thought has been associated with positive outcomes such as post-traumatic growth following a major life crisis (Cann et al., 2011). While it has been proposed that intrusive and deliberate thoughts play different roles in influencing outcomes following stressful experiences, limited research has examined these two styles of ruminative thoughts (Cann et al., 2011). Few studies have conceptualized rumination to include individuals' *purposeful* recurrent thoughts that may serve to understand events and problems, and there has been no research to examine its potential relationship to adaptive problem-solving approaches.

Initial research examining the positive functions of rumination have been promising. Rumination has been identified as an important consideration relative to psychological functioning after experiencing major life stressors (Cann et al., 2011), and has been shown to be positively related to post-traumatic growth in breast cancer survivors (Chan, Ho, Tedeschi, & Leung, 2011). While rumination has been identified as an important emotion-regulation strategy in cancer patients' psychological well-being (Schroevers, Kraaij, & Garnefski, 2008) and has been shown to be a correlate of psychological functioning, it has not been examined among cancer survivors in an exercise context. Considering this initial support for adaptive function of ruminative thought in cancer survivors, the investigation of purposeful ruminative thought among cancer survivors relative to their experience of exercising with cancer-related fatigue could help to develop an understanding about how individuals perceive, manage, and potentially overcome their own fatigue experience. Research in this area may begin to examine questions such as, is adaptive ruminative thought associated with better adjustment to cancer-related fatigue? How does adaptive and maladaptive ruminative thought relate to exercise-related social cognitions?

Purposes of this Study

The aim of this study was to begin to address some of the research needs identified by various PS researchers. Accordingly, in this investigation cancer survivors characterized as more and less effective problem-solvers were examined relative to exercise in the face of cancer-related fatigue, a commonly-reported exercise barrier in this population. The following sections outline the two specific purposes of this study.

Identifying links between problem-solving and exercise social cognitions. The primary purpose of this study was to obtain new information about PS and social-cognitive correlates of exercise in this symptomatic population. Specific variables examined were self-regulatory efficacy, persistence, decisional struggle, perceived fatigue, and fatigue acceptance. These variables have reliable associations to adherence, as noted by theory and past exercise research (e.g., Bandura, 1986; Gyurcsik & Brawley, 2000; Jung & Brawley, 2011). Specifically, the purpose was to identify if social-cognitive differences occur as a function of PS effectiveness among cancer survivors pursuing exercise for health reasons (e.g., therapy, rehabilitation, health promotion).

Identifying differences in positive psychological functioning as function of PS. The secondary purpose of this study was to address the identified gap in PS research relative to positive psychological functioning (PPF). Relative to this secondary purpose, differences between more and less effective problem-solvers on indicators of PPF were examined. Given the focus of this purpose, the positive problem orientation (PPO) subscale of the Social Problem-Solving Inventory-Revised (D'Zurilla, Nezu & Maydeu-Olivares, 2002) was examined relative to PPF. The specific indicators of PPF studied were psychological well-being and rumination. Psychological well-being was assessed using the autonomy subscale from the Ryff Scale of Psychological Well-Being, as this is most relevant with respect to an individual taking control over the self-management of their exercise. Rumination was assessed using the Event-Related Rumination Inventory, which examines different forms of rumination (intrusive and deliberate). While deliberate rumination was examined as the indicator of PPF, considering the exploratory nature of this third study, both intrusive and deliberate rumination were examined so that

findings for deliberate rumination could be compared to the more well-investigated intrusive rumination.

Hypotheses

Relative to the first purpose and consistent with tenets of MSPS, it was expected that more effective problem-solvers would report (a) higher self-regulatory efficacy for exercise, (b) greater anticipated persistence with exercise, (c) less decisional struggle, (d) lower perceived fatigue, and (e) higher fatigue acceptance as compared to less effective problem-solvers (hypotheses 1a through e), when self-managing exercise in the face of the exercise-impeding problem of cancer-related fatigue.

Relative to the second purpose, it was expected that individuals with higher positive problem orientation would report more autonomous psychological well-being and less intrusive rumination (hypothesis 2) than individuals with lower positive problem orientation. No specific hypothesis was advanced relative to deliberate rumination given its exploratory status in the study.

Method

Participants and Design

Thirty five females previously diagnosed with cancer who were enrolled in an exercise program volunteered to take part in this observational study. Participants were between the ages of 25 and 67 years (*Mean* age = 52.3 years, *SD* = 8.1). Thirty-one reported having breast cancer and four reported other types of cancer (i.e., cervical, uterine, nose/throat, mucoepidermoid). Half reported that they were currently receiving cancer treatment. An additional 32 per cent

reported being within 18 months of being diagnosed with cancer and reported that they had received treatment for cancer (chemotherapy and/or radiation therapy and/or surgery). All participants reported experiencing the problem of fatigue associated with cancer and/or its treatment. Given that these participants had recently undergone treatment, their fatigue would be more closely linked to treatment compared to cancer survivors for whom treatment was not recent. Seventy-seven per cent of the sample was married or living with a partner, 70 per cent was working full time, part time, or self-employed, and 17 per cent was retired. All participants regularly attended an exercise program conducted at a major university in western Canada.

Recruitment and Inclusion

Approval for the research was obtained from the relevant institutional ethical review boards at both universities (i.e., University of Saskatchewan and another major western Canadian university) and the director of the exercise programs specifically designed for cancer survivors (see Appendix I). As per recommendations by the director of the exercise programs, initial contact with potential participants was made through exercise class instructors who conducted the exercise programs for cancer survivors, as this would best facilitate participant recruitment. Instructors used ethics-approved targeted announcements and invitational letters provided by the researchers and distributed these to their class participants. As well, posters with information about the study were displayed at the facility to inform potential participants who did not attend structured group exercise, but had access to the facility and chose to exercise on their own. To reach a broader pool of potential participants in this special population in which recruitment was expected to be challenging, instructors emailed an invitation to past participants who had completed the structured exercise program and maintained their regular exercise regimen outside

of the program. Using the recruitment methods described, approximately two months were required to obtain the volunteer participants for the sample.

Fatigue represents a common problem in this special population (See King, Nail, Kreamer, Strohl, & Johnson, 1985; Knobf, 1986; Piper et al., 1989) and requires a solution for individuals to function in daily life as well as to initiate and remain physically active. Thus, individuals recruited were those who reported: (1) experiencing cancer-related fatigue that was related to cancer and/or its treatment; and (2) regularly taking part in exercise (at least one day per week over the past month in a structured cancer-related exercise program or a self-managed exercise program at the cancer exercise program facility. To maximize participation, there were no required specifications for the fatigue experience except that participants self-reported that they have experienced cancer-related fatigue, so that they could relate to the fatigue and exercise-related items in the measures and instructions. Participants were required to regularly participate in exercise (i.e., at least once per week) so that they would have a frame of reference about regular attendance and their ability to attend despite the problem of their cancer-related fatigue.

Measures

All Study Three measures are outlined below. A complete version of these measures is available in Appendix J.

In selecting measures to help answer both hypothesized and exploratory research questions, the issue of participant burden was an important consideration for reasons related to participant fatigue as well as the overall challenge of participant recruitment. For this reason, in some cases, specific subscales of measures were targeted versus using all aspects of a given

measure (e.g., using only the autonomy subscale from a larger measure of PWB). Careful consideration was given to the choice of selected measures and the subscales to avoid burden and withdrawal from the study.

Problem-solving effectiveness. The Social Problem Solving Inventory-Revised (SPSI-R; D’Zurilla, Nezu, & Maydeu-Olivares, 2002) was used to assess PS effectiveness. The theory-based long version of the SPSI-R is a 52-item measure of social PS ability reflecting the five dimensions of the model. As per suggestions from the manual and previous use in the literature, PS effectiveness was determined by using a total score, which combines all five dimensions of PS, positive problem orientation (PPO), negative problem orientation (NPO), rational problem solving (RPS), impulsive/careless style (ICS), and avoidance style (AS). Some example items include, “When I have a problem, I try to see it as a challenge, or opportunity to benefit in some positive way from having the problem” (PPO) and “I wait to see if a problem will resolve itself first, before trying to solve it” (AS). Items were assessed on a 0 (*not at all true of me*) to 4 (*extremely true of me*) scale. The total PSE score was out of 20 based upon weighting that included the 5 dimensions of MSPS and the PPO dimension scores range from 0 to 4. Readers are referred to Study 2 for additional details pertaining to internal consistency and reliability of this measure. In the current study, the mean internal consistency of five scales was acceptable (Cronbach’s alpha = .78; Tabachnick & Fidell, 2007). The internal consistency of the PPO subscale alone was acceptable (Cronbach’s alpha = .71; Tabachnick & Fidell, 2007).

Self-regulatory efficacy (SRE) for exercise in the face of cancer-related fatigue. Participants’ confidence in their ability to exercise in the face of cancer-related fatigue was assessed using the eight-item measure that was used to assess SRE for exercise in Study 1A.

Readers are referred to Study 1A for a complete description of the measure. The measure was modified for exercise in the face of cancer-related fatigue. Participants were asked to imagine that they were now experiencing cancer-related fatigue as they had in the past (inclusion required all to have a cancer-related fatigue experience), and that this experience would not change for the next two weeks. Participants were asked to respond to the items relative to exercising in the face of cancer-related fatigue. An example item from this scale is, “Over the next 2 weeks, how confident are you that you can arrange your weekly schedule in order to do your exercise no matter what?”. Items were assessed using a confidence scale ranging from 0 per cent (*not at all confident*) to 100 per cent (*completely confident*). These items have been used previously in exercise research with individuals in cardiac rehabilitation, with arthritis, and with spinal cord injury (i.e., Brawley et al., 2012; Gyurcsik et al., 2011; Woodgate & Brawley, 2008). Internal consistency was reported to be acceptable and higher, with Cronbach's alphas ranging from .84 to .93. The mean for all 8 items was computed for each participant and used in the analyses. This scale had excellent internal consistency (Cronbach's alpha = .98; Tabachnick & Fidell, 2007).

Anticipated persistence with exercise. Participants' anticipated persistence to exercise when they are fatigued was assessed using the same four-item measure that was used to assess anticipated persistence in Study 1A. The measure was modified to be applicable for exercising when fatigued. Participants were asked to indicate how much (1) time and (2) effort they would be willing to put forth, (c) how willing they would be to persist with their strategies, and (d) how much attention they would be willing to direct toward maintaining their regular exercise regimen when they experience cancer-related fatigue. An example item is, “When you experience cancer-related fatigue, how much effort are you willing to put forth in order to maintain your

regular exercise regimen?”. Participants responded on a 1 (*little or none*) to 9 (*as much as it takes*) scale. The mean for all 4 items was computed for each participant and used in the analyses. This measure has previously been used in exercise research (Jung & Brawley, 2011) as well as Study 2 of the dissertation and reported excellent internal consistency (Cronbach’s alpha = .95). Excellent internal consistency was reported for this scale (Cronbach's alpha - .96; Tabachnick & Fidell, 2007).

Decisional struggle. Participants were asked to report their thoughts about carrying out exercise when they are fatigued. Using a one-item measure on a scale between 1 (*no struggle*) and 9 (*tremendous struggle*), participants were asked to indicate how much these thoughts would make them struggle with their decision to exercise when they are fatigued. This measure has been used previously in exercise research in symptomatic and asymptomatic populations (Glazebrook & Brawley, 2011; Gyurcsik & Brawley, 2000, 2001; Gyurcsik et al., 2002; Gyurcsik & Estabrooks, 2004; Gyurcsik, Brawley, Spink, Glazebrook, & Anderson, 2011). For the purpose of the present study, decisional struggle served as an acute indication of the degree of cognitive rumination participants might experience as a result of negative thoughts, affect, and self-evaluations (Gyurcsik & Brawley, 2000; Maddux & Lewis, 1995).

Perceived fatigue. Participants assessed the cognitive/mood subscale (6 items) of the Piper Fatigue Scale (Piper et al., 1998), which examines fatigue as a subjective perception based on numerous factors. Each item is scored on a 0 to 10 scale, with higher scores indicating more perceived fatigue. These items were used to assess the participants' general experience with fatigue. These 22 items are used to calculate the four sub-scale scores and the total fatigue scores. Fatigue severity was assessed as follows: 0 (*none*); 1-3 (*mild*); 4-6 (*moderate*); and 7-10

(*severe*). The means for each subscale were computed for each participant and used in the analyses. The Piper Fatigue Scale has undergone psychometric evaluation and has been validated in a group of 382 women with breast cancer and reported a standardized alpha of .97. This measure has also previously been used in oncological studies in exercise (i.e., Mock et al, 1997) and reported acceptable internal consistency (Cronbach's alpha = .87 to .96). The measure had excellent internal consistency (Cronbach's alpha = .92; Tabachnick & Fidell, 2007).

Fatigue acceptance. This measure was modified from a measure of pain acceptance from the pain literature (see McCracken, Vowles & Eccleston, 2004). The pain acceptance measure has been used in the exercise literature among exercising individuals with arthritis and among individuals with peripheral artery disease enrolled in cardiac rehabilitation exercise therapy (Gyurcsik et al., 2011; Rejeski, Tian, Liao, & McDermott, 2008). The Activities/Engagement subscale consists of 10 items that examine the degree to which an individual engages in life activities regardless of their pain. This subscale was modified to be applicable for fatigue and used for its relevance to participants engaging in exercise despite experiencing cancer-related fatigue. Items were scored on a 0 (*never true*) to 6 (*always true*) scale. The mean for all 10 items in the subscale was computed for each participant and used in the analyses. An example item is, "I am getting on with the business of living no matter what my level of fatigue is". Good internal consistency was reported for the Activities/Engagement subscale in this study (Cronbach's alpha = .84; Tabachnick & Fidell, 2007).

Psychological well-being (PWB). The Ryff Scale of Psychological Well-Being (Ryff, 1989) is a theoretically grounded instrument that assesses PWB. Participants in this study were assessed using the 9-item autonomy subscale, which examines the extent to which an individual

is self-determining, independent, and able to resist social pressures to think and act in certain ways. This subscale was selected for its relevance to the self-management of exercise behaviour. Taking control over problematic situations requires an individual to make independent, self-determined decisions to best serve their personal interests despite the influence of external factors (i.e., opinions of family and friends). This also applies to managing exercise-related problems (e.g., exercise lapses) despite the influence of others (i.e., opinions of family and friends about exercising when fatigued). An example item from this subscale is, "My decisions are not usually influenced by what everyone else is doing". Each item was assessed on a 0 (*completely disagree*) to 5 (*completely agree*) scale. Negatively scored items were reverse scored before a total score for the subscale was computed for each participant. Higher scores reflect greater levels of PWB. This subscale had good internal consistency (Cronbach's $\alpha = .83$; Tabachnick & Fidell, 2007).

Rumination. The 20-item Event-Related Rumination Inventory (Cann et al., 2011) was used to assess intrusive and deliberate rumination (10 items each). Items assessed participants' thoughts about a particular experience. For the purpose of this study, the cancer experience was the context to which participants responded. Participants indicated how often they found themselves having thoughts about their fatigue experience even though they did not try to think about it (intrusive) and how often they deliberately and intentionally spent time thinking about their experience (deliberate). Items were scored on a 0 (*not at all*) to 3 (*often*) scale. Example items include, "Thoughts about cancer came to my mind and I could not stop thinking about them" (intrusive) and "I thought about whether I could find meaning from my experience with cancer" (deliberate). Research reporting internal consistencies for these subscales reports that these are good to excellent (Cronbach's α s = .94 and .88 for intrusive and deliberate,

respectively). Cronbach's alphas for the current study were excellent for both intrusive (.97) and deliberate (.91) subscales (Tabachnick & Fidell, 2007).

Procedure

The online survey was developed using Fluid Surveys (<http://FluidSurveys.com>), a tool to build web-based questionnaires. All participants completed the one-time survey online at a time and location of their choice. Participants received a link to the online survey via email, letter invitation, or poster. Participants first provided informed consent before completing the study measures. Participants were instructed to complete questions in the order in which they appeared. They first completed the demographics questionnaire, baseline self-regulatory efficacy for exercise (without reference to fatigue), and SPSI-R measure. Next they reported their cancer-related fatigue, fatigue acceptance, self-regulatory efficacy for exercise in the face of cancer-related fatigue, anticipated persistence when facing fatigue, positive and negative thoughts relative to carrying out exercise when fatigued, decisional struggle related to these thoughts, rumination (intrusive and deliberate), and psychological well-being. Participants took an average of 52 minutes to complete the survey. None expressed this as a burden. All participants had their names entered into a draw for a \$50 gift certificate.

Analytic Plan

PS and exercise social cognitions. A one-way MANOVA was conducted to examine differences between more and less effective problem-solvers on exercise social cognitions. Total score for problem-solving effectiveness was used to categorize individuals into two groups. Consistent with past practice in the psychological literature (Bond et al., 2003; Elliott & Marmarosh, 1994), more and less effective problem-solvers were identified by a median split of

problem-solving effectiveness score. Dependent variables were self-regulatory efficacy for exercise in the face of cancer-related fatigue, anticipated persistence, decisional struggle, perceived fatigue, and fatigue acceptance.

Problem-solving and positive psychological functioning. Given the secondary and more exploratory purpose concerning positive psychological functioning, a separate one-way MANOVA was conducted to examine differences in positive psychological functioning (PPF) between individuals with higher and lower positive problem orientation (PPO). Scores for the PPO subscale were used to categorize individuals into two groups (higher and lower positive problem orientation) using a median split. Dependent variables were psychological well-being, intrusive rumination and deliberate rumination.

Results

Data Management and Screening

Data management strategies were employed to address missing data, the presence of outliers, and to assess normality of the data. All steps were in accordance with recommendations made by Tabachnick and Fidell (2007). A brief description is provided here, as a complete overview is available in study 1.

Missing data. Missing data were estimated using mean substitution so as to best represent participants' responses. When one item was missing from a scale, the mean for the remaining items in that scale was used to replace the missing value. When possible, subscale scores were used to best represent the missing item. For example, 2 subjects were missing one item each on the Piper Fatigue Scale. For each of these subjects, the mean for the remaining

items in the same subscale was inserted so as to best represent the participant's responses on that particular subscale. When responses were missing for an entire scale or subscale, the sample mean for each item was used to replace the missing scores.

Outliers. Outliers were sought statistically using the benchmark of a standardized score greater than 3.29 ($p < .001$) away from other z scores for that specific variable. No outliers were detected.

Testing of assumptions. Assumptions of MANOVA include multivariate normality and homogeneity of variance/covariance matrices across groups and were determined to be non-problematic. Potential multicollinearity and singularity among dependent variables were also assessed and determined to be non-problematic.

Descriptive Statistics

Demographic variables. The sample consisted of 35 female volunteer participants. All reported exercise to be an important part of managing cancer-related symptoms such as fatigue. Participants reported attending structured group exercise classes 1.9 ($SD = 1.1$) times per week. The sample also engaged in independent exercise, reporting an average of 2.7 ($SD = 3.3$) sessions per week of strenuous independent exercise and 5.3 ($SD = 3.5$) sessions per week of moderate independent exercise, with a minimum of 20 minutes of continuously activity per session.

Descriptive data. Participants' mean scores and standard deviations are presented in Tables 11 and 12. Correlations between main study variables are available in Appendix K.

Problem-solving and exercise social cognitions. Prior to the MANOVA being conducted, it was empirically verified that problem-solving effectiveness mean scores for more and less effectiveness problem-solvers were significantly different. Mean scores for more and less effective problem-solvers were 15.91 ($SD = 1.35$) and 11.89 ($SD = 1.67$), respectively. Group differences between more and less effective problem-solvers on overall PS effectiveness scores were confirmed with a t -test, $t(32) = 7.7, p < .001$.

Relative to hypothesis 1, a MANOVA revealed a significant between groups multivariate effect of PS effectiveness on SRE for exercise in the face of fatigue, anticipated persistence, decisional struggle, perceived fatigue, and fatigue acceptance, $F(5, 29) = 3.07, Wilks' \lambda = .654, p < .05, partial \eta^2 = .35$, indicating a medium size multivariate effect. Separate follow-up univariate ANOVA's revealed significant differences on perceived fatigue, with more effective problem-solvers reporting less perceived fatigue than their counterpart less effective problem-solvers (hypothesis 1d supported). In order to guard against Type 1 error, a Bonferroni correction was applied (Cohen, 1990). Five familywise tests at $p < .05$ would be interpreted at $p = .01$. Group differences remained significant for perceived fatigue at this adjusted level. Group differences were not evident for fatigue acceptance, SRE for exercise in the face of fatigue, anticipated persistence, and decisional struggle (hypotheses 1 a, b, c and e not supported). Differences in the means for fatigue acceptance were in the hypothesized direction, $p = .068$. The means are reported in Table 11. ¹

¹ In order to address cautions about dichotomization expressed by MacCallum, Zhang, Preacher, & Rucker (2002), appropriate action was taken to address liabilities of a median split by examining the data from a continuous perspective. The findings of this analysis were consistent with the findings reported here, indicating that problem-solving effectiveness was significantly and most strongly related to perceived fatigue.

Problem-solving and positive psychological functioning. Prior to the MANOVA being conducted, it was empirically verified that positive problem orientation (PPO) mean scores for higher and lower positive problem orientation groups were significantly different. Mean scores for higher and lower PPO were 3.13 ($SD = .47$) and 2.05 ($SD = .38$), respectively. Group differences between higher and lower PPO scores were confirmed with a t -test, $t(32) = 7.3, p < .001$.

In accordance with hypothesis 2, a MANOVA revealed a significant multivariate effect of PS effectiveness on psychological well-being, intrusive rumination and deliberate rumination, $F(3, 31) = 3.91, Wilks' \lambda = .725, p < .05, partial \eta^2 = .28$, indicating a multivariate effect. Separate, follow-up univariate ANOVA's revealed significant differences on all variables. Individuals with higher PPO reported higher levels of psychological well-being, less intrusive rumination and less deliberate rumination relative to their lower PPO counterparts. These findings are reported in Table 12. In order to guard against Type 1 error, a Bonferroni correction was applied (Cohen, 1990). Three familywise tests at $p < .05$ would be interpreted at $p = .0167$. Group differences remained significant for psychological well-being and intrusive rumination, but not for deliberate rumination at this adjusted level.

Table 11

Fatigue-Related Variables and Exercise Social Cognitions

	More Effective Problem-Solvers (<i>n</i> = 18)	Less Effective Problem-Solvers (<i>n</i> = 17)	
Measure	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	η^2
Perceived Fatigue	3.52 (1.60)	5.29 (1.26)	.28*
Fatigue Acceptance	4.40 (0.72)	3.96 (0.79)	.08
Self-Regulatory Efficacy for Exercise	77.15 (21.08)	65.09 (21.05)	.08
Anticipated Persistence	7.42 (1.83)	6.42 (1.85)	.07
Decisional Struggle	3.44 (2.36)	4.52 (1.94)	.06

Note. * Denotes $p = .001$, all other p 's range from .097 to .15. Scale range for variables is as follows: Problem-solving effectiveness (0-20); Perceived fatigue (0-10); Fatigue acceptance (0-6); Self-regulatory efficacy (0-100); Anticipated persistence (1-9); Decisional struggle (1-9). Group differences between more and less effective problem-solvers on overall PS effectiveness scores were confirmed with a t -test, $t(32) = 7.7$, $p < .001$.

Table 12

Positive Psychological Function

	Higher PPO (<i>n</i> = 12)	Lower PPO (<i>n</i> = 23)	
Measure	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	η^2
Psychological Well-Being	37.00 (5.17)	31.38 (6.26)	.18*
Deliberate Rumination	1.16 (0.64)	1.65 (0.60)	.13*
Intrusive Rumination	0.53 (0.48)	1.20 (0.84)	.17*

Note: * Denotes $p < .05$. Scale range for variables is as follows: Problem-solving effectiveness (0-4); Deliberate and intrusive rumination (0-3). Psychological well-being total score range is 0 to 45 (0-5 scale range for 9 items); Group differences between higher and lower positive problem orientation scores were confirmed with a t -test, $t(32) = 7.3$, $p < .001$.

Post hoc Analyses

One of the global purposes of the dissertation was to examine initial relationships between problem-solving and social cognitions known to be related to exercise. The data in the present study provided opportunity to explore relationships proposed by Ewart (1990) and Bandura (1997) in this special population of cancer survivors engaged in exercise. To address this, problem-solving relationships proposed by Ewart (1990) and based upon Bandura's social cognitive theory were evaluated. According to these models, in the face of a problem: (1) problem-solving will predict persistence (Ewart, 1990); and (2) SRE beliefs will predict persistence (Bandura, 1997).

A hierarchical multiple regression was conducted to examine the theoretical relationships. Inasmuch as problem-solving effectiveness is the more global measure of psychological approach toward problems, it was entered as the predictor in step 1, SRE as the more specific situational belief about upcoming weeks of exercise in the face of fatigue was entered as the predictor in step 2, with the dependent (criterion) variable being persistence.

Findings of the hierarchical multiple regression indicate that at different steps towards the final model, both variables significantly predicted persistence. As expected, on the first block, PS effectiveness was a significant predictor, accounting for 12 per cent of the variance in persistence, $p < .05$. However, on the second block, SRE accounted for the largest proportion of the variance (i.e., 32 per cent of the variance in persistence, $p < .001$), where the total model $R^2_{adjusted} = .41$. The contribution by PS effectiveness to the model became non-significant after the entry of SRE. These findings are reported in Table 13 below.

Table 13

Predictors of Anticipated Persistence

Predictor	Anticipated Persistence		
	R^2	$R^2\Delta$	β
Step 1		.12*	
PS effectiveness			.13*
Step 2	.44**	.32**	
PS effectiveness			.13
SRE for exercise			.61**
<i>Total model R^2 adjusted</i>	.41**		

Note. N = 35. * $p < .05$, ** $p < .001$.

Discussion

This study addressed some important gaps related to the examination of problem-solving (PS) in exercise adherence among cancer survivors. Through the use of the Model of Social Problem Solving (MSPS) and Social Cognitive Theory (SCT), the primary goal of this research was to examine differences in the social cognitive correlates of exercise adherence as a function of PS effectiveness among cancer survivors facing the problem of cancer-related fatigue. A secondary goal was to investigate differences between selected positive psychological indicators as a function of PS in order to address recommended gaps in the cancer and PS literature.

Differences as a Function of Problem-Solving Effectiveness

Exercise social cognitions. Relative to the primary goal, findings indicate that individuals with higher problem-solving effectiveness reported lower perceptions of fatigue than their lower counterparts. However, no significant differences were observed between more and less effective problem-solvers on fatigue acceptance, self-regulatory efficacy, anticipated

persistence and decisional struggle. Thus, these findings were generally not supportive of the MSPS-based hypothesis that favours an overall psychological advantage for better problem-solvers for these variables.

There may be several possible explanations for the non-significant differences between more and less effective problem solvers on exercise social cognitions and fatigue acceptance. These findings may be attributed to the small differential in PS effectiveness observed between more and less effective problem-solvers. Although group differences were examined and determined to be significant, the two-point differential in the means of the groups' PS effectiveness scores may have been too small for significant differences to be revealed on the dependent variables in question. These small differences are not surprising given that all participants in the sample were regularly attending structured exercise and also exercising independently. It is conceivable that these participants would report scores for exercise-related social cognitions in a similar range. A potential alternative explanation is that prior to participating in this study, participants have always been managing fatigue when exercising. Support for this consideration comes from examination of baseline SRE scores relative to post-problem SRE scores. Simple observation of the SRE means of the PSE groups at baseline compared to post-problem reveals they are virtually identical (*total baseline SRE mean* = 73.3, *total post-problem mean* = 71.4; *baseline SRE means: more effective problem-solvers* = 24.4, *less effective problem-solvers* = 16.3; *post-problem SRE means: more effective problem-solvers* = 21.5, *less effective problem-solvers* = 21.0). Despite this argument, differences were observed for fatigue, therefore, it may be that better PS is a potential advantage for cancer survivors when it comes to managing and perceiving fatigue. The crux of the matter is that fatigue is a common problem among cancer survivors and can act as a barrier to exercise. Therefore, the observed

differences in fatigue as a function of PS effectiveness in this population raise additional questions about significance of PS in fatigue perception and whether PS is related to better symptom management.

Another possible explanation for the non-significant differences could be selected sampling. Participants in this volunteer convenience sample were all regularly active and motivated to continue with programmatic exercise designed specifically for cancer survivors. Participants' scores reflect values expected for regular symptomatic exercisers (i.e., reasonably strong self-regulatory efficacy beliefs for exercise in the face of a challenge, high anticipated persistence when challenged, and low to moderate decisional struggle to exercise; See total scores for sample in Table 10). Related to this same point is that a cancer survivor who is already active may exhibit higher acceptance of their fatigue. Inasmuch as high scores were evident for both groups across the sample, this was not unexpected for regular exercisers, particularly considering that the subscale of interest was activities engagement (i.e., the degree to which one is engaged in life activities despite fatigue). Thus, while between-group differences were in the hypothesized direction for these variables, it is possible that the combination of small sample size, modest difference in group means (due to truncated use of the higher end of scales by both groups in this exercising sample), and large standard deviations for some variables may have mitigated against the detection of differences.

Positive psychological functioning. Relative to the secondary goal of examining whether positive problem orientation differentiates participants in terms of indicants of positive psychological functioning, findings were supportive of MSPS-based hypotheses. More effective problem-solvers reported greater psychological well-being. While no specific hypothesis was

advanced for deliberate rumination, more effective problem-solvers reported less deliberate rumination.

In regard to positive psychological functioning (PPF), this study addressed an important gap identified in the PS literature and specific research recommendations about PS and PPF (Chang, Downey & Salata, 2004; D'Zurilla & Nezu, 2007). These authors identified the need (a) for more PS research in different populations that fits within a positive framework, and (b) to examine how MSPS relates to other indicants of positive psychological variables. In addition to PWB, as an indicant of PPF, deliberate rumination had not previously been examined in the cancer and exercise context. No specific hypothesis was advanced about how PS would relate to deliberate rumination, primarily because this study is one of the first in problem-solving and exercise to operationalize rumination using the Event-Related Rumination Inventory. This measure considers both adaptive and maladaptive aspects of rumination, thereby offering a broader operationalization of rumination, defined generally as "repetitive thought, pondering or meditating on information" (Cann et al., 2011, p.138). Past research has primarily examined rumination as negative repetitive thought, equating it with worry (Ehring, Frank, & Ehlers, 2008; Michael, Halligan, Clark, & Ehlers, 2007). Study findings indicate that more effective problem-solvers reported less intrusive and less deliberate rumination than their less effective counterparts. Findings relative to intrusive rumination were consistent with expectations that more effective problem-solvers would express less intrusive rumination.

With respect to deliberate rumination, it seemed plausible that more effective problem-solvers would engage in more deliberate ruminations as they sought solutions to problems that they encountered. However, findings do not support this contention. One possible explanation

is that more effective problem-solvers may be more confident in their solutions. Thus, allocating additional attention to the task of seeking solutions would be superfluous, not cognitively economical, and thus less beneficial. Some insight about this speculation is offered by past exercise research in the efficacy domain. For example, after investigating a sample of employed mothers interested in exercise who were presented with either many or few significant exercise barriers, Jung and Brawley (2011) reported no significant differences in the number of solutions to barriers reported between individuals with higher and lower self-regulatory efficacy for concurrently managing exercise and other life goals in the face of a greater and lesser number of barriers. In this study, the fact that higher self-regulatory efficacy individuals did not present more solutions than their lower counterparts was attributed to their greater confidence in a single solution and knowing that the solution would work. In the present study, it is possible that more effective problem-solvers did not feel the need to ruminate over their problem, as they were more confident about their solutions and their effectiveness. Thus, low deliberate rumination scores may have indicated that they did not need to actively engage in additional solution seeking.

Exploring other theory-based relationships. An exploratory analysis was also conducted to examine some of the other theoretical relationships relative to PS effectiveness and exercise social cognitions examined in Study 2. This post hoc analysis was conducted to determine whether theory-based PS and self-regulatory efficacy relationships with persistence would be observed in this special population of exercising cancer survivors (Bandura, 1986; Ewart, 1990). This analysis indicated relationships were consistent with theory. Moreover, this analysis offered new findings, specifically with respect to the relationship between PS and self-regulatory efficacy for exercise and anticipated persistence with exercise in the face of a challenge. Recall that Study 2 findings with cardiac rehabilitation participants supported SCT

tenets that self-regulatory efficacy is related to persistence in the face of a challenge. However, Ewart's (1990) proposition that PS predicts persistence was not supported in that study. In the present study, the post-hoc analysis revealed that both PS and SRE for exercise were significant predictors of persistence in the face of a challenge when examined separately, although when entered together, PS became a non-significant predictor of persistence when SRE was entered into the same model. These relationships are limited to this sample of exercising cancer survivors, and may not be generalizable to a less active sample.

Strengths and Limitations

Consistent with Studies 1 and 2, one of the key strengths of this research was the examination of the relationships that were based upon strong theoretical foundations. Another strength of this study was its use of a relevant and salient problem that was experienced by all participants. In the previous two studies, participants read relevant scenario-based stimulus materials before responding to study measures. While the quality of the scenarios and their interpretation as relevant problems were verified using appropriate checks, the use of and reference to the real and ongoing problem of fatigue experienced by cancer survivors is a study improvement given its salience to all participants. Furthermore, this study was the first to examine links between exercise and fatigue among cancer survivors who were currently undergoing treatment or recently completed treatment, a time when adherence to regular exercise is recognized to be particularly challenging.

Despite these strengths, there are also some key tradeoffs and limitations of the study that should be noted. Whereas an important PS research gap was addressed by studying an active sample of cancer survivors, the specificity of the volunteer convenience sample and the specific

problem (cancer-related fatigue), inherently limits the generalizability of these findings. Another limitation is the small sample size, which may have resulted in some analyses being underpowered.

General Discussion

Reviews of physical activity interventions have recognized problem-solving to be an important behavioural strategy that is combined with others in successful interventions that promote adherence to physical activity and other health behaviours (i.e., Artinian et al., 2010). However, evidence supporting problem-solving as an advantageous individual strategy for promoting exercise adherence is limited. While the exercise literature consists of studies that investigate problem-solving in conjunction with other behavioural strategies, the specific role of problem-solving is unknown.

The purpose of this dissertation was to investigate problem-solving relative to adjustment to exercise lapses. This initial research examined relationships between problem-solving and exercise-related social cognitions related to adherence. These relationships were examined in the context of specific problems that may cause a lapse in exercise. Using two theoretical frameworks that describe problem-solving, three studies were conducted to examine proposed relationships in various asymptomatic and symptomatic exercising samples. Study 1 consisted of two parts, each examining theory-based relationships. Consistent with relationships proposed by social cognitive theory (SCT), Study 1A demonstrated that self-regulatory efficacy beliefs significantly predicted problem-solving approach, and that stronger efficacy beliefs were associated with an adaptive approach to problems, as suggested by significant positive associations between self-regulatory efficacy and task-diagnostic problem-solving approach.

SCT-based relationships between SRE and perceived difficulty and persistence were also examined and supported. Consistent with the model of social problem-solving (MSPS), Study 1B demonstrated that problem-solving effectiveness was positively associated with social cognitive correlates of exercise adherence linked to adaptation. These correlates included self-regulatory efficacy for managing exercise in the face of a lapse-related problem and task-diagnostic problem-solving approach.

Building on this initial demonstration of relationships, Study 2 examined problem-solving among novice participants in cardiac rehabilitation (CR) exercise therapy who were faced with a problem that could provoke an extended lapse. Consistent with SCT contentions, proposed relationships were observed between self-regulatory efficacy for CR exercise and persistence with CR exercise, and between self-efficacy and persistence relative to two distinct aspects of the process of problem-solving (i.e., identifying solutions to problems and implementing solutions). MSPS relationships were also supported relative to problem-solving process components. Study findings revealed significant relationships between problem-solving effectiveness and (a) self-efficacy for problem-solving (seeking solutions to problems), (b) persistence with problem-solving, (c) self-efficacy for solution implementation (carrying out solutions) and (d) persistence with solution implementation. Differences between more and less effective problem-solvers were also observed on (a) self-efficacy for problem-solving, (b) persistence with problem-solving, (c) self-efficacy for solution implementation and (d) persistence with solution implementation. Greater confidence and persistence with seeking solutions to problems and carrying out solutions may set the stage for better adjustment to a problem situation among more effective problem-solvers.

Study 3 investigated problem-solving among cancer survivors and demonstrated partial support for differences between more and less effective problem-solvers on exercise social cognitions and fatigue-related variables. This study also investigated an under-examined area in problem-solving research, the relationship between problem-solving and positive psychological functioning. Findings indicated significant differences between more and less effective problem-solvers on selective indicators of positive psychological functioning, offering support for MSPS contentions. Table 14 provides a summary of the findings from the three studies. Collectively, this series of studies helps to advance the exercise and problem-solving literature in several ways. The following sections describe some key contributions.

Table 14

Summary of Study Findings

Study	Relationship examined	Result
1A	↑ SRE → ↑ task-diagnostic PS approach ↑ SRE → ↓ self-diagnostic PS approach ↑ task-diagnostic PS approach → ↓ change in SRE	Supported Supported Supported
1A	↑ SRE → ↑ anticipated persistence ↓ perceived difficulty → ↑ anticipated persistence	Supported Supported
1B	↑ PSE → ↑ baseline SRE ↑ PSE → ↑ post-problem SRE ↑ PSE → ↑ anticipated persistence ↑ PSE → ↑ task-diagnostic PS approach ↑ PSE → ↓ self-diagnostic PS approach	Supported Supported Not supported Supported Supported
2	<u>Relative to CR exercise:</u> ↑ SRE → ↑ anticipated persistence ↑ PSE → ↑ SRE ↑ PSE → ↑ anticipated persistence <u>Relative to PS and SI components of PS process:</u> ↑ SE → ↑ anticipated persistence ↑ PSE → ↑ SE ↑ PSE → ↑ anticipated persistence	Supported Not supported Not supported Supported Supported Supported
2	Differences between more and less effective problem-solvers on the following dependent variables: SRE for CR exercise Anticipated persistence with CR exercise SRE for PS Anticipated persistence with PS SRE for SI Anticipated persistence with SI	Supported ✓ ✓ ✓ ✓ ✓ ✓
3	Differences between more and less effective problem-solvers on the following dependent variables: SRE for exercise Anticipated persistence Decisional struggle Perceived fatigue Fatigue acceptance	Limited Support × × × ✓ ×
3	Differences between more and less effective problem-solvers on the following dependent variables: Psychological well-being Intrusive rumination Deliberate rumination	Supported ✓ ✓ ✓

Note. Abbreviations are as follows: SRE is self-regulatory efficacy; SE is self-efficacy; PS is problem-solving; SI is solution implementation; PSE is problem-solving effectiveness. Symbols: ✓ indicates that univariate ANOVA was significant, × indicates that univariate ANOVA was not significant.

Contribution to Research on Exercise Interventions

According to Painter and colleagues, interventions are most effective when they are based on theory. Rejeski and colleagues (2000) recommend that researchers design interventions that target process variables (Painter et al., 2008; Rejeski et al, 2000). The literature on exercise intervention research identifies the need for examining process components of interventions to better understand how intervention outcomes are achieved (Andersen, 1992; 2002; Baranowski, Lin, Wetter, Resnicow & Hearn, 1997). However, in any emerging area of research, an important step is to first identify these process variables. This is true of exercise and problem-solving research.

These dissertation studies examined theory-based relationships in problem-solving and exercise with a specific focus on variables that may be linked to process. The studies examined relationships between problem-solving and known correlates of exercise such as self-efficacy, a social cognition that has consistently and strongly been associated with exercise (i.e., Conn et al., 2003). The focus on process components is an initial step toward addressing recommendations of Anderson (1992; 2002) and Baranowski et al. (1997) to examine process components in an effort to understand more about process.

Another important consideration relative to examining PS is to distinguish between two problem-solving process components (identifying solutions to problems and carrying out solutions). These components are conceptually different and involve different skills and should be considered separately for their unique contributions to adjustment (D'Zurilla & Nezu, 2007). The present research represents a first attempt to address this relative to an exercise lapse situation in which exercise was challenged. This study represents initial research that offers

clear, empirical support for the link between problem-solving and social cognitive indicators of adherence.

Research Gaps and Recommendations Addressed

The studies also contribute to the problem-solving literature by investigating identified gaps and addressing several research recommendations that focused on cardiac rehabilitation and on cancer survivors.

Addressing disease-specific research needs. Behavioural lifestyle changes are important for the prevention of serious medical conditions such as cancer and cardiovascular disease (Artinian et al., 2010), and exercise is identified as one key lifestyle change that can offer both preventative and rehabilitative benefits (cf. D'Zurilla & Nezu, 2007). Problem-solving interventions are specifically recommended to help individuals overcome various obstacles and conflicts associated with chronic conditions. Cancer and cardiovascular disease, two of the leading causes of death in developing countries, are identified to be particularly important to investigate with respect to problem-solving (D'Zurilla & Nezu, 2007; Ewart, 1990). While there has been some research in problem-solving in cancer, problem-solving in cardiac patients has not been examined (D'Zurilla & Nezu, 2007). Studies two and three address this gap in the problem-solving literature.

Positive psychological functioning. Much of the research on problem-solving has focused on negative or maladaptive functioning associated with problem-solving deficiencies, or on problem-solving relative to health conditions and disorders. However, the problem-solving literature also states the importance of examining problem-solving relative to increasing positive functioning. D'Zurilla & Nezu (2007) identified this area as a research need. This is particularly

relevant in the physical activity domain considering that psychological well-being is a mental health consequence of exercise (Biddle, Fox, Boutcher, & Faulkner, 2000). This study examined problem-solving relative to positive psychological functioning thereby extending previous observations to problem-solving in physical activity. Study three both addresses the research need and contributes to an emerging literature (e.g., D'Zurilla & Nezu, 2007).

Limitations

Design and sample size. All studies in this dissertation were cross-sectional, limiting conclusions to the interpretation of relationships. Despite small samples in all studies, significant effects were generally detected. Future efforts could build on current research by conducting studies with larger and more diverse samples.

Measurement. Given that problem-solving approach has not previously been examined in exercise, validated measures of task and self-diagnostic problem-solving approaches, as described in social cognitive theory, were not available for use in Study 1A. Existing measures of problem-solving (e.g., Social Problem-Solving Inventory-Revised) operationalize problem-solving in accordance with the five-dimension MSPS. While self-report measures of problem-solving (i.e., SPSI-R, Problem-Solving Inventory) are widely used in the problem-solving studies, readers are cautioned that these assess self-appraised problem-solving rather than actual problem-solving ability, which would require the use of performance measures such as the Means-Ends Problem Solving measure (D'Zurilla & Nezu, 2007).

Generalizability. Participants in all three dissertation studies were regularly participating in structured exercise. Although some participants in Studies two and three were involved in independent exercise also, all three studies mainly concerned lapses in structured

exercise. Therefore, the generalizability of these study findings is limited to the specific samples and settings (i.e., active, self-selected volunteers attending structured exercise/exercise therapy). Considering that the stimulus materials in Studies two and three are disease-specific, generalizability to other diseased or asymptomatic populations with varying problems (i.e., different symptoms) or with alternate motivation to exercise (i.e., not for symptom management) may not be appropriate.

Finally, most of the subjects in this series of studies reported at least moderate problem-solving ability (i.e., above the midpoint of the SPSI-R scale). Therefore, findings may not be generalizable to individuals with problem-solving deficiencies. Considering that past research suggests greater responsiveness to problem-solving interventions from individuals with negative appraisals, or less adaptive problem-solving, future investigations in exercise that examine individuals with lower scores on problem-solving measures may be worth consideration (cf. Linden & Satin, 2007).

Strengths

One of the strengths of this series of studies is the attention to specific problems within each sample. Elliott and colleagues emphasize the importance of approaching specific samples to determine sample-specific elements that constitute a problem, rather than allowing research and/or clinical need to dictate these (Elliott et al., 2004). Stimulus materials used in these studies were pilot-tested within the specific study sample prior to their use to assure that the problem was salient, important and relevant for each sample. Given the concern raised by Painter et al. (2008) regarding the limited amount of theory-driven health behavior research, another strength of the studies in general is the use of the complementary theories of SCT and MSPS.

Future Directions

To begin to address some of the limitations described above, future studies may consider examining the generalizability of the observed relationships in other special populations. Furthermore, recruiting larger and more diverse samples would be desirable as this may offer variability in exercise social cognitions and problem-solving abilities. Larger samples would also help to overcome issues related to power as well as issues associated with normality (i.e., non-normal distributions). For example, recruiting individuals who are less experienced with exercise, in addition to those who are more experienced would render a more diverse range of responses that could be more informative about problem-solving and reactions to lapse situations.

Future studies may also examine which aspects of problem-solving are associated with adaptive behaviours. For example, problem orientation is identified to be distinct from problem-solving style and has been underscored in problem-solving training research as the essential component (D'Zurilla & Perri, 1989; Nezu et al., 1989). However, more dismantling studies are needed where problem-solving training based on the full MSPS model (e.g., training in all dimensions of problem-solving) is compared to abbreviated problem-solving training (e.g., training in problem orientation only) to better understand the importance of each aspect.

Another interesting direction would be to examine a possible reciprocal causation hypothesis (D'Zurilla & Nezu, 2007), which suggests the possibility of a reciprocal relationship between problem-solving and related beliefs about adherence behaviours. While hypotheses have been proposed relative to psychopathology (D'Zurilla & Nezu, 2007), a possible reciprocal relationship between problem-solving and exercise social cognitions could be examined, where

problem-solving may lead to social cognitions, which in turn impact future adaptive problem-solving efforts. Investigation of this cyclical hypothesis has been proposed relative to positive cycles enhancing positive functioning over time as well as negative cycles increasing maladjustment. Extending this idea, potential research questions would be: “does adaptive problem-solving promote psychological well-being?” and “does improved psychological well-being subsequently facilitate more effective problem-solving?”. The reciprocity questions would require either longitudinal studies with multiple assessments of problem-solving and adherence over time or temporally ordered experimental studies. Such options for investigation suggest a rich number of opportunities that could be explored relative to problem-solving and exercise for both health enhancement and disease prevention.

References

- Andersen, B.L. (1992). Psychological interventions for cancer patients to enhance the quality of life. *Journal of Consulting and Clinical Psychology*, 60(4), 552-68.
- Andersen, B.L. (2002). Biobehavioral outcomes following psychological interventions for cancer patients. *Journal of Consulting and Clinical Psychology*, 70, 590-610.
- Artinian, N.T., Fletcher, G.F., Mozaffarian, D., Kris-Etherton, P., Van Horn, L., Lichtenstein, A.H.,...Burke, L.E. (2010). Interventions to promote physical activity and dietary lifestyle changes for cardiovascular risk reduction in adults. *Circulation*, 122, 406-441. doi: 10.1161/CIR.0b013e3181e8edf1
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.
- Bandura, A. (2004). Health promotion by social cognitive means. *Health Education & Behavior*, 31, 143-164.
- Bandura, A. & Wood, R. (1989). Effect of Perceived Controllability and Performance Standards on Self-Regulation of Complex Decision Making, *Journal of Personality and Social Psychology*, 56(5), 805-814.
- Baranowski, T., Lin, L.S., Wetter, D.W., Resnicow, K., & Hearn, M.D. (1997). Theory as mediating variables: Why aren't community interventions working as desired? *Annals of Epidemiology*, 7,S89-S95.

- Barone, D. F., Maddux, J. E. & Snyder, C. R. (1997). *Social cognitive psychology. History and current domains*. New York: Plenum Press.
- Biddle, S.J.H., Fox, K.R., Boutcher, S.H., & Faulkner, G.E. (2000). The way forward for physical activity and the promotion of psychological well-being. In S.J.H. Biddle, K.R. Fox, & S.H. Boutcher, (Eds.) *Physical activity and psychological well-being* (pp. 154-168). New York, NY: Routledge.
- Bond, D.S., Lyle, R.M., Tappe, M.K., Seehafer, R.S., & D'Zurilla, T.J. (2002). Moderate aerobic exercise, t'ai chi, and social problem-solving ability in relation to psychological stress. *International Journal of Stress Management*, 9(4), 329-343.
- Brownell, K.D., Marlatt, G.A., Lichtenstein, E., & Wilson, G.T. (1986). Understanding and preventing relapse, *American Psychologist*, 41, 765-782.
- Cann, A., Calhoun, L.G., Tedeschi, R.G., Triplett, K.N., Vishnevsky, T., & Lindstrom, C.M. (2011). Assessing post-traumatic cognitive processes: The event-related rumination inventory. *Anxiety, Stress, & Coping*, 24(2), 137-156.
- Carlson, J.J., Norman, G.J., Feltz, D.R., Franklin, B.A., Johnson, J.A., & Locke, S.K. (2001). Self-efficacy, psychosocial factors, and exercise behavior in traditional versus modified cardiac rehabilitation. *Journal of Cardiopulmonary Rehabilitation*, 21, 363-373.
- Chan, M.W.C., Ho, S.M.Y., Tedeschi, R.G., & Leung, C.W.L. (2011). The valence of attentional bias and cancer-related rumination in posttraumatic stress and posttraumatic growth among women with breast cancer, *Psycho-Oncology*, 20, 544-554.

- Chang, E.C., & D’Zurilla, T.J. (1996). Relations between problem orientation and optimism, pessimism, and trait affectivity: a construct validation study. *Behavior Research & Therapy*, 34, 185-194.
- Chase, J.A. (2011). Systematic review of physical activity intervention studies after cardiac rehabilitation, *Journal of Cardiovascular Nursing*, 26(5), 351-358. doi: 10.1097/JCN.0b013e3182049f00.
- Conn, V. S., Minor, M. A., Burks, K. J., Rantz, M. J. and Pomeroy, S. H. (2003). Integrative review of physical activity intervention research with aging adults. *Journal of the American Geriatrics Society*, 51, 1159-68.
- Cormier, W.H., Otani, A., & Cormier, L.S. (1986). The effects of problem-solving training on two problem-solving tasks, *Cognitive Therapy and Research*, 10(1), 95-108.
- Curt, G.A., Breitbart, W., Cella, D., Groopman, J.E., Horning, S. J., Itri, L.M., Johnson, D.H., Miaskowski, C., Scherr, S.L., Portenoy, R.K. et al. (2000). Impact of cancer related fatigue on the lives of patients: New findings from the Fatigue Coalition. *Oncologist*, 5, 353-360.
- Doorenbos, A., Givens, B., Given, C. Verbitsky, N, Cimprich, B., & McCorkle, R. (2005). Reducing symptom limitations: A cognitive behavioral intervention randomized trial, *Psycho-oncology*, 14, 574-584.
- Dreer, L. Elliott, T.R., & Tucker, E. (2004). Social problem-solving abilities and health behaviors among persons with recent onset spinal cord injury. *Journal of Clinical Psychology in Medical Settings*, 11(1), 7-13.

- D'Zurilla, T.J. (1986). *Problem-solving therapy: A social competence approach to clinical intervention*, New York: Springer Publishing.\
- D'Zurilla, T.J., & Nezu, A.M. (1999). *Problem-Solving Therapy: a Social Competence Approach to Clinical Intervention*. New York: Springer.
- D'Zurilla, T. J., & Nezu, A. M. (2007). *Problem-solving therapy: A positive approach to clinical intervention* (3rd ed.). New York: Springer Publishing Co.
- D'Zurilla, T.J., Nezu, A.M., & Maydeu Olivares, A. (2002). *Social Problem-Solving Inventory-Revised (SPSI-R)*. North Tonawanda, NY: Multi-Health Systems, Inc.
- Ehring, T., Frank, S., & Ehlers, A. (2008). The role of rumination and reduced concreteness in the maintenance of posttraumatic stress disorder and depression following trauma. *Cognitive Research and Therapy*, 32, 488-506. doi:10.1107/s10608-006-9089-7
- Elliott, T.R. (1992). Problem-solving appraisal, oral contraceptive use, and menstrual pain, *Journal of Applied Social Psychology*, 22, 286-297.
- Elliott, T.R., Godshall, F., Herrick, S., Witty, T., & Spruell, M. (1991). Problem-solving appraisal and psychological adjustment following spinal cord injury. *Cognitive Therapy and research*, 15, 387-398.
- Elliott, T.R., Grant, J.S., & Miller, D.M. (2004). Social problem-solving abilities and behavioral health. In E.C. Chang, T.J. D'Zurilla, & L. Sanna, (Eds.) *Social problem solving: Theory, research, and training* (pp. 117-133). Washington, DC: American Psychological Association.

- Elliott, T.R., Herrick, S., MacNair, R., & Harkins, S. (1994). Personality correlates of self-appraisal problem-solving ability: Problem orientation and trait affectivity, *Journal of Personality Assessment*, 63, 489-505.
- Elliott, T.R., Johnson, M.O., & Jackson, R. (1997). Social problem solving and health behaviors of undergraduate students. *Journal of College Student Development*, 38, 24-31.
- Elliott, T.R., & Marmarosh, C. (1994). Problem solving appraisal, health complaints, and health-related expectancies. *Journal of Counseling and Development*, 72, 531-537.
- Ewart, C.K. (1990). A social problem-solving approach to behavior change in coronary heart disease. In S. Shumaker, E. Schron, & J. Ockene (Eds.), *Handbook of health behavior change* (pp. 153-190). New York Springer. New York, NY, US: Springer Publishing Co, Inc.
- Ferrer, R.A., Huedo-Medina, T.B., Johnson, B.T., Ryan, S.M., & Pescatello, L.S. (2011). Exercise interventions for cancer survivors: A meta-analysis of quality of life outcomes. *Annals of Behavioral Medicine*, 41(1), 32-47. doi: 10.1007/s12160-010-9225-1
- Glazebrook, K.E., & Brawley, L.R. (2011). Thinking about maintaining exercise therapy: does being positive or negative make a difference? *Journal of Health Psychology*, 16(6), 905-16. doi: 10.1177/1359105310396391
- Godshall, F.J., & Elliott, T.R. (1997). Behavioral correlates of self-appraised problem-solving ability: Problem-solving skills and health-compromising behaviors. *Journal of Applied Social Psychology*, 27(11), 929-944.

- Gyurcsik, N.C., Brawley, L.R. (2000). Mindful deliberation about exercise: Influence of acute positive and negative thinking. *Journal of Applied Social Psychology*, 30, 2513-2533.
- Gyurcsik, N.C., & Brawley, L.R. (2001). Is the glass half-full or half-empty? The relationship of big and little optimism to acute and longer-term social cognitions. *Journal of Applied Biobehavioral Research*, 6, 108-127.
- Gyurcsik, N.C., Brawley, L.R., Spink, K.S., Brittain, D.R., Fuller, D.L., & Chad K. (2009). Physical activity in women with arthritis: examining perceived barriers and self-regulatory efficacy to cope. *Arthritis Rheumatism*, 61(8), 1087-94.
- Gyurcsik, N.C., Brawley, L.R., Spink, K.S., Glazebrook, K.E., & Anderson, T.J. (2011). Is level of pain acceptance differentially related to social cognitions and behavior? The case of active women with arthritis. *Journal of Health Psychology*, 16(3), 1-10. doi: 10.1177/1359105310394229
- Gyurcsik, N.C., & Estabrooks, P.A. (2004). Acute exercise thoughts, coping, and exercise intention in older adults. *Journal of Applied Social Psychology*, 34(6), 1131–1146. doi: 10.1111/j.1559-1816.2004.tb01999.x
- Heppner, P.P., Hibel, J., Neal, G.W., Weinstein, C.L., & Rabinowitz, F.E. (1982) Personal problem solving: A descriptive study of individual differences. *Journal of Counseling Psychology*, 28, 580-590.

- Holman, H. R., & Lorig, K. (1992). Perceived self-efficacy in self-management of chronic disease. In R. Schwarzer (Ed.), *Self-efficacy: Thought control of action*. (pp. 305-323). Washington, DC: Hemisphere.
- Jung, M.E., & Brawley, L.R. (2011). Exercise persistence in the face of varying exercise challenges: A test of self-efficacy theory in working mothers, *Journal of Health Psychology*, 16, 5728-5738. doi: 10.1177/1359105310388322.
- Kahn, E.B., Ramsey, L.T., Brownson, R.C., Heath, G.W., Howze, E.H., Powell, K.E., et al. (2002). The effectiveness of interventions to increase physical activity. A systematic review. *American Journal of Preventive Medicine*, 22(4) 173-107.
- Katzmarzyk, P.T., Gledhill, N., & Shephard, R.J. (2000). The economic burden of physical inactivity in Canada. *Canadian Medical Association Journal*. 163, 11, 1435-40.
- Kendzierski, D., & Johnson, W. (1993) Excuses, excuses, excuses: a cognitive behavioral approach to exercise implementation. *Journal of Sport and Exercise Psychology*, 15, 207-219.
- King, K.B., Nail, L.M., Kreamer, K., Strohl, R.A., & Johnson, J.E. (1985). Patients' descriptions of the experience of receiving radiation therapy. *Oncology Nursing Forum*, 12(4), 55-61.
- Kirshbaum, M.N. (2006). A review of the benefits of whole body exercise during and after treatment for breast cancer. *Journal of Clinical Nursing*, 16(1), 104-121.

- Knobf, M.K. (1986). Physical and psychological distress associated with adjuvant chemotherapy in women with breast cancer, *Oncology Nursing Forum*, 10, 28-33.
- Linden W., Satin, J.R. (2007). Avoidable pitfalls in behavioural medicine outcome research. *Annals of Behavioral Medicine*, 33(2), 143-147.
- Loprinzi, P.D., Cardinal, B.J., Si, Q., Bennett, J.A., & Winters-Stone, K.M. (2012). Theory-based predictors of follow-up exercise behavior after a supervised exercise intervention in older breast cancer survivors, *Supportive Care in Cancer*, 1-11.
- Lorig, K.R., & Holman, H.R. (2003) Self-management education: History, definition, outcomes, and mechanisms, *Annals of Behavioral Medicine*, 26(1), 1-7.
- Lox, C.L., Martin Ginis, K.A., & Petruzzello, S.J. (2006). *The psychology of exercise: Integrating theory and practice*, 2nd edition. Scottsdale, AZ: Holcomb-Hathaway.
- MacCallum, R. C., Zhang, S., Preacher, K. J., & Rucker, D. D. (2002). On the practice of dichotomization of quantitative variables. *Psychological Methods*, 7, 19–40. doi: 10.1037//1082-989X.7.1.19
- Maddux, J. E., & Gosselin, J. T. (2003). Self-efficacy. In M. R. Leary & J. P. Tangney (Eds.), *Handbook of self and identity* (pp. 218–238). New York: The Guildford Press.
- Maddux, J., & Lewis, J. (1995). Self-efficacy and adjustment: Basic principles and issues. In J.E. Maddux (Ed), *Self-efficacy, adaptation, and adjustment: Theory, research, and application* (pp.37– 68). New York, NY, US: Plenum Press.

- Mancuso, C.A., Sayles, W., Robbins, L. & Allegrante, J.P. (2010). Novel use of patient-derived vignettes to foster self-efficacy in an asthma self-management workbook, *Health Promotion Practice*, 11, 44-53. doi: 10.1177/1524839907309865
- Marlatt, G.A., & Gordon, J.R. (1985). *Relapse Prevention: Maintenance Strategies in the Treatment of Addictive Behaviors*. New York: Guilford Press.
- Martin, L.L., & Tesser, A. (1996). Clarifying our thoughts. In R.S. Wyer Jr (ed.). *Ruminative thought* (pp.189-208). Hillsdale, NJ: Lawrence Erlbaum Associates. Inc.
- Maydeu-Olivares, A., & D'Zurilla, T.J. (1995). A factor analysis of the Social Problem-Solving Inventory using polychoric correlations. *European Journal of Psychological Assessment*, 11, 98-107.
- Maydeu-Olivares, A., & D'Zurilla, T.J. (1996). A factor analytic study of the Social Problem-Solving Inventory: An integration of theory and data. *Cognitive Therapy and Research*, 20, 115-133.
- McAuley, E., & Mihalko, S. L. (1998). Measuring exercise- related self-efficacy. In J. L. Duda (Ed.), *Advances in sport and exercise psychology measurement* (pp. 371–381). USA: Fitness Information.
- McCracken, L.M., Vowles, K.E., & Eccleston, C. (2004). Acceptance of chronic pain: Component analysis and revised assessment method. *Pain*, 107, 159-166.
doi:10.1016/j.pain.2003.10.012

- Meichenbaum, D., & Turk, D. (1987). *Facilitating treatment adherence: A practitioner's guidebook*. New York: Plenum Press.
- Michael, T., Halligan, S.L., Clark, D.M., & Ehlers, A. (2007). Rumination in posttraumatic stress disorder. *Depression and Anxiety*, 24, 307-317. doi:10.1002/da.20228
- Mock, V., Dow, K.H., Meares, C.J., Grimm, P.M., Dienemann, J.A., Haisfield-Wolfe, M.E. et al. (1997). Effects of exercise on fatigue, physical functioning, and emotional distress during radiation therapy for breast cancer. *Oncology Nursing Forum*, 24, 991-1000.
- Mock, V., Frangakis, C., Davidson, N.E., Ropka, M.E., Pickett, M., & Poniatowski, B. (2005). Exercise manages fatigue during breast cancer treatment: A randomized controlled trial. *Psychooncology*, 14(6):464-477.
- Nezu, A.M. (1985). Differences in psychological distress between effective and ineffective problem solvers. *Journal of Counseling Psychology*, 32, 135-138.
- Nezu, A.M. (1986a) .Cognitive appraisal of problem-solving effectiveness: Relation to depression and depressive symptoms. *Journal of Clinical Psychology*, 42, 847-852.
- Nezu, A.M. (1986b). Negative life stress and anxiety: Problem solving as a moderator variable. *Psychological Reports*, 58, 279-283.
- Nezu, A.M. (1987). A problem-solving formulation of depression. A literature review and proposal of pluralistic model. *Clinical Psychology Review*, 7, 121-144.

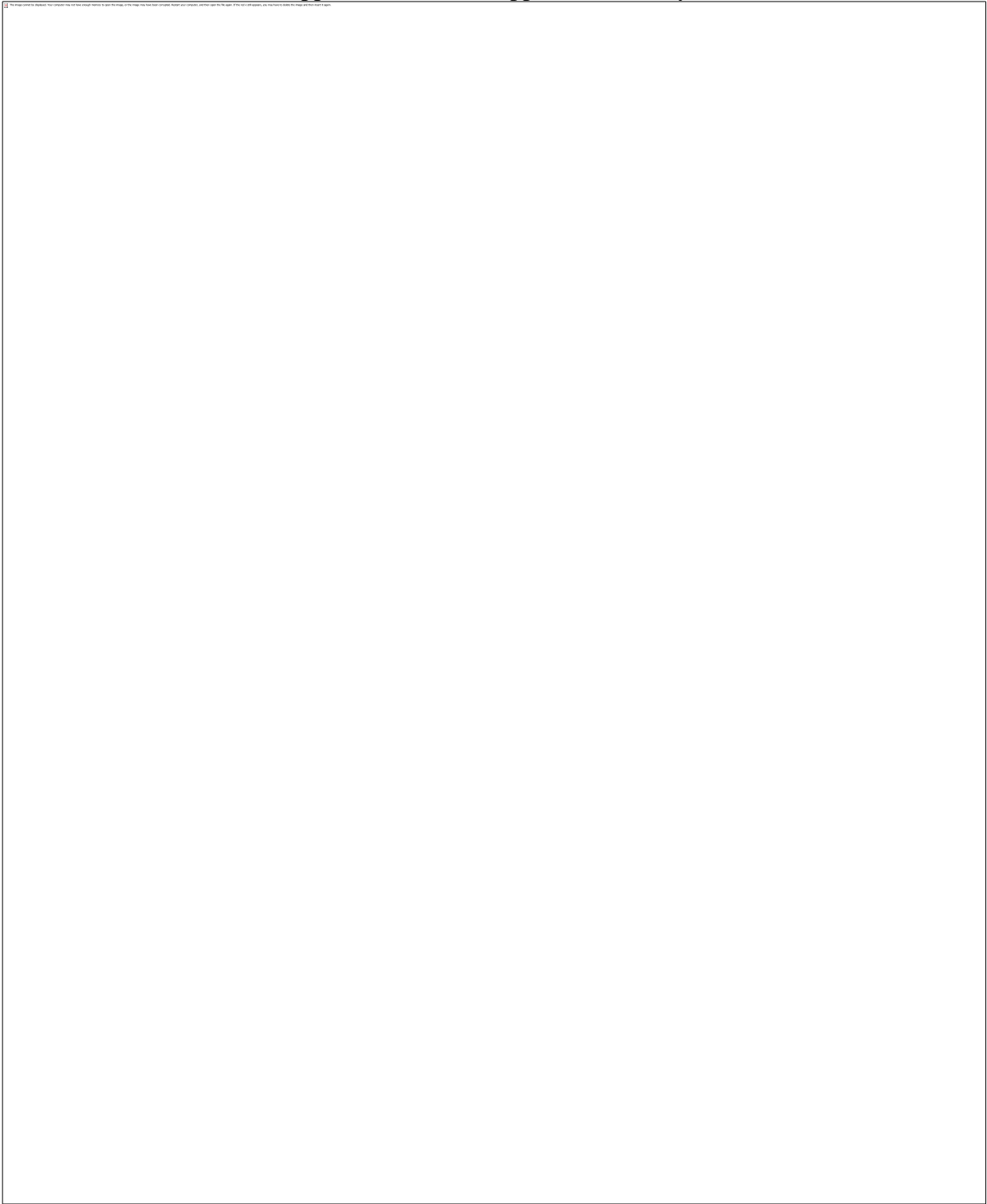
- Nezu, A.M., & Carnevale, G.J. (1987). Interpersonal problem solving and coping reactions of Vietnam veterans with posttraumatic stress disorder. *Journal of Abnormal Psychology*, 96, 155-157.
- Nezu, A.M., Nezu, C.M., Felgoise, S.H. McClure, K.S., & Houts, P.S. (2003). Project genesis: Assessing the efficacy of problem-solving therapy for distressed adult cancer patients, *Journal of Consulting and Clinical Psychology*, 71(6), 1036-48.
- Nezu, A. M., Nezu, C. M., Friedman, S. H., Faddis, S., & Houts, P. S. (1998). *A problem solving approach, Helping cancer patients cope*. American Psychological Association, Washington, DC.
- Nezu, A.M., Nezu, C.M., & Perri, M.G. (1989). *Problem-solving therapy for depression: Theory, research, and clinical guidelines*. New York: Wiley.
- Osborne, R.H., Wilson, T., Lorig, K.R., & McColl, G.J. (2007). Does self-management lead to sustainable health benefits in people with arthritis? A 2-year transition study of 452 Australians. *Journal of Rheumatology*, 34(5), 1112-7.
- Painter, J.E., Borba, C.P.C., Hynes, M., Mays, D., Glanz, K. (2008). The use of theory in health behavior research from 2000 to 2005: A systematic review. *Annals of Behavioral Medicine*, 35, 358-362.
- Piper, B.F., Dibble, S.L., Dodd, M.J., Weiss, M.C., Slaughter, R.E., & Paul, S.M. (1998). The revised Piper Fatigue Scale: psychometric evaluation in women with breast cancer. *Oncology Nursing Forum*, 25(4). 677-684.

- Priebe, C.S., Flora, P.K., Ferguson, L.J., & Anderson, T.J. (2012). Using efficacy information to manipulate proxy efficacy in novice exercisers, *Psychology of Sport and Exercise*, 13(5), 562-268.
- Prior, P.L., Francis, J., Reitav, J., & Stone, J.A. (2009). Behavioural, Psychological and Functional Issues. In Canadian Guidelines for Cardiac Rehabilitation and Cardiovascular Disease Prevention: Translating knowledge into action (3rd edition), pp. 107-178.
- Rejeski, W.J., Brawley, L.R., Ambrosius, W.T., Brubaker, P.H., Focht, B.C., Foy C.G., & Fox, L.D. (2003). Older adults with chronic disease: The benefits of group mediated counselling in the promotion of physically active lifestyles. *Health Psychology*, 22, 414-423.
- Rejeski, W.J., Tian, L., Liao, Y., & McDermott, M.M. (2008). Social cognitive constructs and the promotion of physical activity in patients with peripheral artery disease. *Journal of Cardiopulmonary Rehabilitation and Prevention*, 28(1), 65–72.
- Rejeski, J., Brawley, L. R., & Jung, M. E. (2008). Self Management of Health Behavior in Geriatric Medicine. In: *Hazzard's Principles of Geriatric Medicine and Gerontology*, 6th ed. Publisher: McGraw-Hill Companies.
- Seligman, M.E.P., & Csikszentmihalyi, M. (2000). Positive psychology. *American Psychologist*, 55(1), 5-14.
- Soo, S., Burney,S., & Basten, C. (2009). The role of rumination in affective distress in people with a chronic physical illness, *Journal of Health Psychology*, 14(7), 956-966. doi: 10.1177/1259105309341204

- Strachan, S.M., Flora, P.K., Brawley, L.R., & Spink, K.S. (2011). Varying the cause of a challenge to exercise – identity behaviour: Reactions of individuals of differing identity strength. *Journal of Health Psychology, 16*(4), 572-583. doi: 10.1177/1359105310383602
- Tabachnik, B. G., & Fidell, L. S. (2007). *Using multivariate statistics*, 5th edition. Boston: Pearson/Allyn & Bacon.
- Vallance, J.K., Courneya, K.S., Jones, L.W., & Reiman, T. (2005). Differences in quality of life between non-Hodgkin's lymphoma survivors meeting and not meeting public health exercise guidelines, *Psycho-oncology, 14*, 979-991.
- Watkins, E.R. (2008). Constructive and unconstructive repetitive thought. *Psychological Bulletin, 134*, 163-206. doi:10.1037/0033-2909.134.2.163
- Williams, J.G., & Kleinelter, K.J. (1989). Perceived problem solving skills and drinking patterns among college students. *Psychological Reports, 65*, 1235-1244.
- Wood, R., & Bandura, A. (1989). Impact of conceptions of ability on self-regulatory mechanisms and complex decision making. *Journal of Personality and Social Psychology, 56*, 407-415.
- Woodgate, J., & Brawley, L.R. (2008). Use of an efficacy-enhancing message to influence the self-regulatory efficacy of cardiac rehabilitation participants: A field experiment. *Rehabilitation Psychology, 53*(2), 153-161. doi: 10.1037/0090-5550.53.2.153

Woodgate, J., Brawley, L. R., & Weston, Z. (2005). Maintenance cardiac rehabilitation exercise adherence: Effects of task and self-regulatory self-efficacy. *Journal of Applied Social Psychology, 35*, 183–197.

Appendix A: Ethics Approval for Study 1



QUESTIONNAIRE PACKAGE

Thank you for taking the time to participate in this study. This questionnaire will take approximately 20 minutes to complete. Please answer each question honestly. If you feel uncomfortable answering any question, you may choose to skip over it if you wish. If you have any questions at all, please feel free to email or call the researchers at anytime.

Demographic Information

What is your email address? _____
(For contact and honoraria purposes only)

What is your age? _____

What is your gender? ☐ Male ☐ Female

What is your current marital status? ☐ Married ☐ Single ☐ Widowed/Divorced

Are you a university student? ☐ Yes ☐ No

If yes, which level of study are you enrolled in? ☐ Undergraduate ☐ Graduate

If yes, which College are you enrolled in? _____

How would you describe your current involvement with exercise (check all that apply)?

☐ I take part in structured, instructor-led exercise classes (e.g., aerobics, spinning, aquafit, yoga, etc) at least 2 times per week

☐ I primarily take part in structured, instructor-led exercise classes as part of my exercise routine.

☐ I regularly do some independent exercise sometimes

☐ I do some independent exercise sometimes, but it is irregular

In the past month, how many times per week did you attend an exercise class led by an instructor? 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, more than 10.

In the past month, how many times per week did you exercise on your own outside of the class? 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, more than 10.

Baseline Self-Regulatory Efficacy for Exercise

INSTRUCTIONS: The following questions are about your exercise participation. Please think of your typical weekly exercise participation and use the scale below to rate your confidence in carrying out each of the following actions related to exercising *over the next 4 weeks*:

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Not at all										Extremely
Confident										Confident

1. Over the next 4 weeks, how confident are you that you can arrange your weekly schedule in order to do your exercise no matter what?
2. Over the next 4 weeks, how confident are you that you will develop solutions to cope with **unexpected** barriers that can interfere with your exercise?
3. Over the next 4 weeks, how confident are you that you can make up times during the same week when you miss your exercise sessions?
4. Over the next 4 weeks, how confident are you that you will maintain your regular exercise frequency even though it may be difficult at times?
5. Over the next 4 weeks, how confident are you that you will resume your regular exercise frequency when it is interrupted and you miss exercise for a few days?
6. Over the next 4 weeks, how confident are you that you will develop plans for each exercise session to reach your desired level (i.e., intensity) of exercise?
7. Over the next 4 weeks, how confident are you that you can make a plan of action to maintain your current exercise frequency each week, **despite things that can prevent you from carrying out planned exercise?**
8. Over the next 4 weeks, how confident are you that you can prevent other things from interfering with your efforts to maintain your current exercise frequency each week?

Post-Problem Self-Regulatory Efficacy for Exercise

INSTRUCTIONS: Recall the situation described earlier. Please answer the following sets of questions under the assumption that ALL AVAILABLE EXERCISE CLASSES have been COMPLETELY CANCELLED and are unavailable for the next 4 weeks.

Please use the scale below to rate your confidence in carrying out each of the following actions related your exercise *over the next 4 weeks*:

‘Exercise problem’ refers to the cancellation of all available exercise classes for the next 4 weeks.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Not at all										Extremely
Confident										Confident

1. Over the next 4 weeks, how confident are you that you can arrange your weekly schedule in order to do your exercise no matter what?
2. Over the next 4 weeks, how confident are you that you will develop solutions to cope with **unexpected** barriers that can interfere with your exercise?
3. Over the next 4 weeks, how confident are you that you can make up times during the same week when you miss your exercise sessions?
4. Over the next 4 weeks, how confident are you that you will maintain your regular exercise frequency even though it may be difficult at times?
5. Over the next 4 weeks, how confident are you that you will resume your regular exercise frequency when it is interrupted and you miss exercise for a few days?
6. Over the next 4 weeks, how confident are you that you will develop plans for each exercise session to reach your desired level (i.e., intensity) of exercise?
7. Over the next 4 weeks, how confident are you that you can make a plan of action to maintain your current exercise frequency each week, **despite things that can prevent you from carrying out planned exercise?**
8. Over the next 4 weeks, how confident are you that you can prevent other things from interfering with your efforts to maintain your current exercise frequency each week?

Problem-Solving Approach

INSTRUCTIONS: Recall the situation described earlier. Please answer the following sets of questions under the assumption that ALL AVAILABLE EXERCISE CLASSES have been COMPLETELY CANCELLED and are unavailable for the next 4 weeks.

Please continue to reflect on the thoughts you had when you learned that all exercise classes were completely cancelled for the next 4 weeks. Use the scale below to rate the degree to which each of the following statements reflects your thoughts.

	7	6	5	4	3	2	1	0	
Reflects my thoughts very much									Doesn't reflect my thoughts at all

After I learned that all available exercise classes were completely cancelled for the next 4 weeks:

1. I began to assess the problem.
2. I began to solve the problem.
3. I brainstormed possible solutions for overcoming the problem and getting exercise.
4. I reflected on how unprepared I was for doing regular exercise without structured classes.
5. I thought that I would be exercising less than usual because the situation was out of my control.
6. I thought about how, and from whom, I might enlist help in order to continue being active.
7. I immediately thought that I have no way of dealing with this problem.
8. I was reminded of previous times when I could not attend structured classes and how I didn't deal with this well.
9. Regardless of how challenging it is to find a solution, I felt if I persisted, I'd be successful.
10. Although the situation might be difficult, I believed that finding another way to exercise regularly was possible.
11. I thought about finding another way to exercise right away.
12. I believed that I could solve the exercise problem on my own if I tried hard enough.
13. I saw the cancellation as a challenge to overcome, not a problem.
14. I was frustrated with the situation.
15. I worried that now there would be no way for me to get any regular exercise.
16. I felt helpless and believed that I had no control over this situation.
17. I felt irritated and thought that I had lost something that was important to me.
18. I thought about how difficult it would be to start exercise when classes were available again.
19. I felt I had lost something that I had worked hard to have under control.
20. I wondered why these types of things always happen to me.
21. I thought that I already have enough things to deal with.
22. I thought that this is just one more thing to add to my stress level.

Anticipated Persistence

INSTRUCTIONS: Recall the situation described earlier. Please answer the following sets of questions under the assumption that ALL AVAILABLE EXERCISE CLASSES have been COMPLETELY CANCELLED and are unavailable for the next 4 weeks.

Please use the scale below to rate your persistence with respect to **carrying out planned exercise** and maintaining your current exercise frequency each week.

1. Each and every week, how much **time** are you willing to put forth in order to **carry out planned exercise** and maintain your current exercise frequency for the next 4 weeks?

1	2	3	4	5	6	7	8	9
Little or no time								As much time as it takes

2. Each and every week, how much **effort** are you willing to put forth in order to **carry out planned exercise** and maintain your current exercise frequency for the next 4 weeks?

1	2	3	4	5	6	7	8	9
Little or no effort								As much effort as it takes

3. Each and every week, how willing are you **to persist** with your strategies in order to **maintaining planned exercise** at your current exercise frequency for the next 4 weeks?

1	2	3	4	5	6	7	8	9
Will not persist at all								Will persist with strategies

4. Each and every week, how much of your **attention** are you willing to direct toward **maintaining planned exercise** at your current exercise frequency for the next 4 weeks?

1	2	3	4	5	6	7	8	9
Little to no attention toward this								Will direct complete attention toward this

Perceived Difficulty/Problem Check

INSTRUCTIONS: Recall the situation described earlier. Please answer the following sets of questions under the assumption that ALL AVAILABLE EXERCISE CLASSES have been COMPLETELY CANCELLED and are unavailable for the next 4 weeks.

Please use the scale below to rate the degree to which you believe that it would be difficult to **carry out planned exercise** and maintain your current exercise frequency *over the next 4 weeks*.

1. Given the circumstances of class cancellation, how difficult do you believe it would be to **carry out planned exercise** and **maintain** your current exercise frequency over the next 4 weeks?

1	2	3	4	5	6	7	8	9
Not at all difficult				Somewhat difficult				Extremely difficult

Message Quality Check

INSTRUCTIONS: The following questions are about the scenario that you read.

Please use the following scale to rate each item:

1	2	3	4	5	6	7	8	9
Strongly disagree								Strongly Agree

The written scenario presented a challenging situation

The written scenario was aimed at people like me

The written scenario was believable

Appendix C: Stimulus Material for Study 1

INSTRUCTIONS: Please read the following scenario carefully and try to PLACE YOURSELF IN THE SITUATION described. The questions which follow will be in reference to how YOU would react to the situation.

For some time now, you have been doing most of your exercise by exercising regularly in structured, instructor-led exercise classes. Sometimes you find it challenging to maintain your regular exercise regimen because you have a busy schedule. In the past 4 weeks you have not missed any classes that you planned to attend. Today you arrived at the exercise facility for your scheduled class, only to discover that your exercise classes have been completely cancelled and none are available to you for the next 4 weeks.

Please answer the following sets of questions under the assumption that ALL AVAILABLE EXERCISE CLASSES have just been COMPLETELY CANCELLED and are unavailable for the next 4 weeks.

Appendix D: Correlations between main study variables for Study 1

	1	2	3	4	5	6	7
1. PS Effectiveness	-						
2. SRE (baseline)	.460**	-					
3. SRE (post-problem)	.399**	.640**	-				
4. Perceived Difficulty	-.242*	-.186	-.534**	-			
5. Anticipated Persistence	.197	.508**	.600**	-.342**	-		
6. Task-diagnostic PS	.327**	.445**	.668**	-.516**	.586**	-	
7. Self-diagnostic PS	-.370**	-.448**	-.536**	.278*	-.290**	-.434**	-

Note. ** Denotes correlation is significant at the 0.01 level (2-tailed). * Denotes correlation is significant at the 0.05 level (2-tailed). Abbreviations: PS is problem-solving, SRE is self-regulatory efficacy.

Appendix E: Ethics Approval for Study 2

The image cannot be displayed. Your computer may not have enough memory to open the image, or the image may have been corrupted. Restart your computer, and then open the file again. If the red x still appears, you may have to delete the image and then insert it again.

Appendix F: All measures for Study 2

Demographic Information

IMPORTANT: The information below is strictly for the purpose of describing participants in general. This information will be kept private. Please select only one answer unless otherwise specified.

1. How long have you been a cardiac rehabilitation program participant?

- ☐ Between 1 and 4 weeks (less than 1 month)
☐ Between 4 and 8 weeks (1 to 2 months)
☐ Between 8 and 12 weeks (2 to 3 months)
☐ Between 12 and 16 weeks (3 to 4 months)
☐ Between 16 and 20 weeks (4 to 5 months)
☐ Between 20 and 24 weeks (5 to 6 months)
☐ More than 6 months (please specify time) _____ (yrs / months)

2. ON AVERAGE, how many times per week do you attend the cardiac rehabilitation program?

- ☐ 0 times ☐ 1 time per week ☐ 2 times per week ☐ 3 times per week ☐ Other
(Specify) _____

3. In each cardiac rehabilitation session, how many minutes do you spend doing moderate to high intensity exercise? In your calculation, please include minutes of continuous exercise that is either a strength exercise (i.e., lifting weights) or aerobic exercise (i.e., walking, biking). For example, during a one-hour session, you may spend time changing clothes, warming up, talking, etc. DO NOT include this in your calculation. Only include the number of minutes that you spend doing moderate to high intensity exercise.

Number of minutes _____

4. ON AVERAGE, how many times per week do you do independent exercise outside of the cardiac rehabilitation program sessions (i.e., exercise at home, at the mall, extra days at the Field House or elsewhere)?

Please count only those days when you do exercise that is:

-continuous

-either a strength exercise (lifting weights) or aerobic exercise (i.e., walking, biking)

-at least 20 minutes in duration

-DO NOT include household chores (i.e., cleaning, grocery shopping, gardening, etc)

- ☐ 0 times ☐ 1 time per week ☐ 2 times per week ☐ 3 times per week ☐ Other
(Specify) _____

5. In each independent exercise session that you counted above, how many minutes do you spend doing moderate to high intensity exercise? In your calculation, please include exercise that is:

Number of minutes _____

6. In the 3 months prior to attending cardiac rehabilitation, did you attend any structured exercise classes/sessions?

- ☐ Yes, I attended exercise classes very regularly.
☐ Yes, I attended exercise classes, but not regularly.
☐ No I did not attend classes, but I did exercise on my own.
☐ No I did not attend classes and rarely exercised on my own.

7. Is this your first time attending cardiac rehabilitation?

- ☐ Yes
☐ No, I have attended cardiac rehabilitation in the past

8. Age: _____

9. Gender: ☐ Male ☐ Female

10. Height: _____

11. Weight: _____

12. Marital Status:

- ☐ Married ☐ Divorced ☐ Separated ☐ Single ☐ Widowed ☐ Common Law

13. Employment Status:

- ☐ Retired ☐ Homemaker ☐ Employed ☐ Unemployed ☐ Other
(Specify) _____

14. Diagnoses: (Check all that apply)

- ☐ Myocardial Infarction ☐ Angina ☐ Bypass Surgery ☐ Angioplasty/angiogram
☐ Stent ☐ Other (Specify) _____

15. Number of cardiac episodes: _____

16. Health-related problems: (Check all that apply)

- ☐ Arthritis ☐ Asthma ☐ Diabetes ☐ High Blood Pressure
☐ High Cholesterol ☐ Any Cancer ☐ Stomach Problem ☐ Thyroid Problems

17. Smoking Status:

- ☐ Never Smoked ☐ Past Smoker ☐ Current Smoker

18. Please provide your email address or phone number: _____

Your email or phone number is required for contact purposes only if you wish to be included in the draw, however, it will not be linked to your responses so that your confidentiality is ensured.

Baseline Self-Regulatory Efficacy for Cardiac Rehabilitation Exercise

INSTRUCTIONS: The following questions are about your cardiac rehabilitation sessions. Please think of your typical week and use the scale below to rate your confidence for each of the following actions related to exercise at cardiac rehabilitation *over the next 4 weeks*:

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Not at all										Extremely
Confident										Confident

1. Over the next 4 weeks, how confident are you that you can arrange your weekly schedule in order to attend cardiac rehabilitation no matter what?
2. Over the next 4 weeks, how confident are you that you can develop solutions to cope with **unexpected** barriers that can interfere with cardiac rehabilitation?
3. Over the next 4 weeks, how confident are you that you can make up times during the same week when you miss cardiac rehabilitation?
4. Over the next 4 weeks, how confident are you that you can maintain your regular attendance at cardiac rehabilitation even though it may be difficult at times?
5. Over the next 4 weeks, how confident are you that you can resume your regular cardiac rehabilitation attendance when it is interrupted and you miss exercise for a few days?
6. Over the next 4 weeks, how confident are you that you can develop plans for each cardiac rehabilitation session to reach your desired level (i.e., intensity) of exercise?
7. Over the next 4 weeks, how confident are you that you can make a plan of action to maintain your current attendance at cardiac rehabilitation each week, **despite things that can prevent you from attending planned sessions?**
8. Over the next 4 weeks, how confident are you that you can prevent other things from interfering with your efforts to maintain your current attendance at cardiac rehabilitation each week?

Post-Problem Self-Regulatory Efficacy for Cardiac Rehabilitation Exercise

INSTRUCTIONS: Recall the problem scenario described earlier. Please answer the following sets of questions under the assumption that YOU are in the problem situation described.

The problem that you are facing is that you are trying to fit in many things that are very important to you, including needs (e.g., cardiac rehabilitation), interests (e.g., volunteering), responsibilities (e.g., regular family life, extra help for your friend), and unexpected tasks (e.g., granddaughter's school program). You expect that things will be stressful as you try to get everything done and overcome this problematic situation. You don't see how this will change for at least the next 4 weeks.

Please answer the following sets of questions to indicate how you would react in this situation. Please use the scale below to rate your confidence in carrying out each of the following actions related exercise at cardiac rehabilitation ***over the next 4 weeks:***

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Not at all										Extremely
Confident										Confident

1. Over the next 4 weeks, how confident are you that you can arrange your weekly schedule in order to attend cardiac rehabilitation no matter what?
2. Over the next 4 weeks, how confident are you that you can develop solutions to cope with **unexpected** barriers that can interfere with cardiac rehabilitation?
3. Over the next 4 weeks, how confident are you that you can make up times during the same week when you miss cardiac rehabilitation?
4. Over the next 4 weeks, how confident are you that you can maintain your regular attendance at cardiac rehabilitation even though it may be difficult at times?
5. Over the next 4 weeks, how confident are you that you can resume your regular cardiac rehabilitation attendance when it is interrupted and you miss exercise for a few days?
6. Over the next 4 weeks, how confident are you that you can develop plans for each cardiac rehabilitation session to reach your desired level (i.e., intensity) of exercise?
7. Over the next 4 weeks, how confident are you that you can make a plan of action to maintain your current attendance at cardiac rehabilitation each week, **despite things that can prevent you from attending planned sessions?**
8. Over the next 4 weeks, how confident are you that you can prevent other things from interfering with your efforts to maintain your current attendance at cardiac rehabilitation each week?

Anticipated Persistence with Cardiac Rehabilitation Exercise

INSTRUCTIONS: Recall the problem scenario described earlier. Please answer the following sets of questions under the assumption that YOU are in the problem situation described.

The problem that you are facing is that you are trying to fit in many things that are very important to you, including needs (e.g., cardiac rehabilitation), interests (e.g., volunteering), responsibilities (e.g., regular family life, extra help for your friend), and unexpected tasks (e.g., granddaughter's school program). You expect that things will be stressful as you try to get everything done and overcome this problematic situation. You don't see how this will change for at least the next 4 weeks.

Please use the scale below to rate your persistence to attend cardiac rehabilitation and not miss any sessions so you maintain your current exercise frequency each week.

1. Each and every week, how much time are you willing to put forth into finding a way to attend cardiac rehabilitation and maintaining your current exercise frequency for the next 4 weeks?									
1	2	3	4	5	6	7	8	9	
Little or no time								As much time as it takes	
2. Each and every week, how much effort are you willing to put into finding a way to attend cardiac rehabilitation and maintaining your current exercise frequency for the next 4 weeks?									
1	2	3	4	5	6	7	8	9	
Little or no effort								As much effort as it takes	
3. Each and every week, how willing are you to persist with your plan to attend cardiac rehabilitation and maintain your current exercise frequency for the next 4 weeks?									
1	2	3	4	5	6	7	8	9	
Will not persist at all								Will persist with strategies	
4. Each and every week, how much of your attention are you willing to direct toward finding a way to attend cardiac rehabilitation and maintain your current exercise frequency for the next 4 weeks?									
1	2	3	4	5	6	7	8	9	
Little to no attention toward this								Will direct complete attention toward this	

Self-Efficacy for Problem-Solving

The following is a list of some steps that are part of identifying solutions to a problem.

Defining the problem

Generating possible solutions

Selecting a solution to implement

These 3 steps are part of the problem solving process. The goal of these steps is to identify a solution plan, but not to **implement the solution**.

INSTRUCTIONS: Recall the problem scenario described earlier. Please answer the following sets of questions under the assumption that YOU are in the problem situation described.

The problem that you are facing is that you are trying to fit in many things that are very important to you, including needs (e.g., cardiac rehabilitation), interests (e.g., volunteering), responsibilities (e.g., regular family life, extra help for your friend), and unexpected tasks (e.g., granddaughter's school program). You expect that things will be stressful as you try to get everything done and overcome this problematic situation. You don't see how this will change for at least the next 4 weeks.

Please answer the following sets of questions to indicate how you would respond in this situation. Please use the scale below to rate your confidence in carrying out each of the following actions related your exercise *over the next 4 weeks*:

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Not at all										Extremely
Confident										Confident

Defining the problem

After reading the scenario, and before drawing any conclusions about what exactly the problem is, what caused it, or how you will solve it, please rate how confident you are that you can:

1. Actively seek out all available facts about the problem (Who, What, When, Where, How).
2. Describe the problem objectively, separating facts from assumptions.

Generating possible solutions

After reading the scenario, if you were asked to brainstorm all the possible solutions that you could think of, please rate how confident you are that you can:

1. List ALL possible solutions without judging the feasibility of any of your ideas.
2. Think of as many possible solutions as you can without evaluating them.

Selecting a solution to implement

After brainstorming all the possible solutions, and considering each idea to be equal in quality and potential (don't judge them), please rate how confident you are that you can:

1. Identify ALL possible positive outcomes for each possible solution (For example, consider ALL the positive personal, social, short-term, long-term outcomes of each suggestion).
2. Identify ALL possible negative outcomes for each possible solution (For example, consider ALL the negative personal, social, short-term, long-term outcomes of each suggestion).
3. Assess each solution based on all these positive and negative outcomes.
4. Identify a plan of action which maximizes the positive consequences and minimizes the negative consequences.
5. Select the best option or combination of options to create the best overall solution plan.

Anticipated Persistence with Problem-Solving

Recall that there are 3 steps to identifying solutions to a problem. These are:

Defining the problem

Generating possible solutions

Selecting a solution to implement

These 3 steps are part of the problem solving process. The goal of these steps is to identify a solution plan, but they **do not include implementing the solution**.

Considering the actions involved with the 3 steps of identifying a solution to a problem:

How much time are you willing to put forth in order to engage in the 3 steps of problem solving to identify a solution plan that could be carried out?									
1	2	3	4	5	6	7	8	9	
Little or no time									As much time as it takes
How much effort you are willing to put forth in order to engage in the 3 steps of problem solving to identify a solution plan that could be carried out?									
1	2	3	4	5	6	7	8	9	
Little or no effort									As much effort as it takes
How willing are you to persist with the 3 steps of problem solving to identify a solution plan that could be carried out?									
1	2	3	4	5	6	7	8	9	
Will not persist at all									Will persist with strategies
How much of your attention are you willing to direct to engage in the 3 steps of problem solving to identify a solution plan that could be carried out?									
1	2	3	4	5	6	7	8	9	
Little to no attention toward this									Will direct complete attention toward this

Identify Solutions

INSTRUCTIONS: Recall the situation described earlier. Please list possible solutions to this situation. List as many as you can think of.

Select Best Solution

INSTRUCTIONS: From the solutions that you listed, please select one solution that you believe is the **BEST SOLUTION** to the problem. Please identify the solution number from the list that you made:

My best solution is SOLUTION # _____

Self-Efficacy for Solution Implementation

INSTRUCTIONS: The following questions relate to your confidence to **carry out the solution** to a problem once a solution has been identified. Recall the **BEST SOLUTION** that you identified above and respond to these questions with that best solution in mind.

Please use the scale below to rate your confidence in carrying out each of the following behaviours as they relate to carrying out your **BEST SOLUTION**.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Not at all										Extremely
Confident										Confident

Solution Implementation

Once you have identified a solution to the problem, how confident are you that you can:

1. Predict the outcomes of your attempt on your solution (i.e., likelihood that you will successfully solve the problem)?
2. Carry out the solution as planned with few errors?
3. Evaluate the success of your attempted solution?
4. Troubleshoot to improve future attempts?

Anticipated Persistence with Solution Implementation

INSTRUCTIONS: Recall the **BEST SOLUTION** that you identified above and respond to these questions with that best solution in mind.

How much time are you willing to put forth in order to carry out this solution?									
1	2	3	4	5	6	7	8	9	
Little or no time								As much time as it takes	
How much effort are you willing to put forth in order to carry out this solution?									
1	2	3	4	5	6	7	8	9	
Little or no effort								As much effort as it takes	
How willing are you to persist with the plan to carry out this solution?									
1	2	3	4	5	6	7	8	9	
Will not persist at all								Will persist with plan	
4) How much of your attention are you willing to direct to carrying out this solution?									
1	2	3	4	5	6	7	8	9	
Little to no attention toward this								Will direct complete attention toward this	

Problem Check

INSTRUCTIONS: Please rate how stressful you perceive the problem scenario to be.

1	2	3	4	5	6	7	8	9
Not stressful at all			Somewhat stressful			Extremely stressful		

Message Quality Check

INSTRUCTIONS: Please respond to the following questions by circling the number that best describes your answer.

Please use the following scale to rate each item:

1	2	3	4	5	6	7	8	9	
Strongly Disagree									Strongly Agree

1. The person in the problem scenario could be someone like me.
2. The problem scenario was believable.
3. The problem scenario was easy to read.
4. The problem scenario was understandable.
5. I could easily place myself in this situation.
6. The situation described was realistic.

Appendix G: Stimulus material for Study 2

INSTRUCTIONS: Please read the following scenario carefully and try to PLACE YOURSELF IN THE SITUATION described. The questions that follow relate to how YOU would react if you were in this situation.

As a member of the cardiac rehabilitation program, you have been exercising at the Field House. During the last 4 weeks, you have not missed any sessions that you planned to attend. It is very important to you to continue to do your exercises regularly. You are already starting to feel better about your health and you also feel safe exercising at the Field House where therapists are close by. You are also really enjoying spending time with your new friends. For these reasons, it is just not an option for you to miss cardiac rehabilitation sessions.

In addition to attending the program, you have been spending some time helping out a close friend who recently underwent surgery. You have been helping with caregiving, as well as helping to run some of their errands while they recover. Some of your time is also spent volunteering at a community organization. Between all these activities and your life with your family at home, your time is pretty booked up. Needless to say you have been feeling quite busy lately.

Things were manageable until yesterday when your granddaughter called and left a message for you, asking you to participate in her school program, and she seemed very excited about having you there. Her message said that the program will start next week and will run on Mondays and Fridays for the next 4 weeks. You would really like to take part because you value your relationship with your granddaughter and this would allow you to spend time together. You have conflicting interests because this program overlaps with the time that you usually exercise at the Field House. You fear that she might have promised your involvement before consulting with you. She has very high expectations of you because she doesn't realize how many other things you are involved with.

The problem that you are facing is that you are trying to fit in many things that are very important to you, including needs (e.g., cardiac rehabilitation), interests (e.g., volunteering), responsibilities (e.g., regular family life, extra help for your friend), and unexpected tasks (e.g., granddaughter's school program). You will have to make some decisions quickly, but you don't want to let anyone down. One thing is for sure, while you try to meet all of the demands, you cannot miss your scheduled exercise at cardiac rehabilitation. You expect that things will be stressful as you try to get everything done and overcome this problematic situation. You don't see how this will change for at least the next 4 weeks.

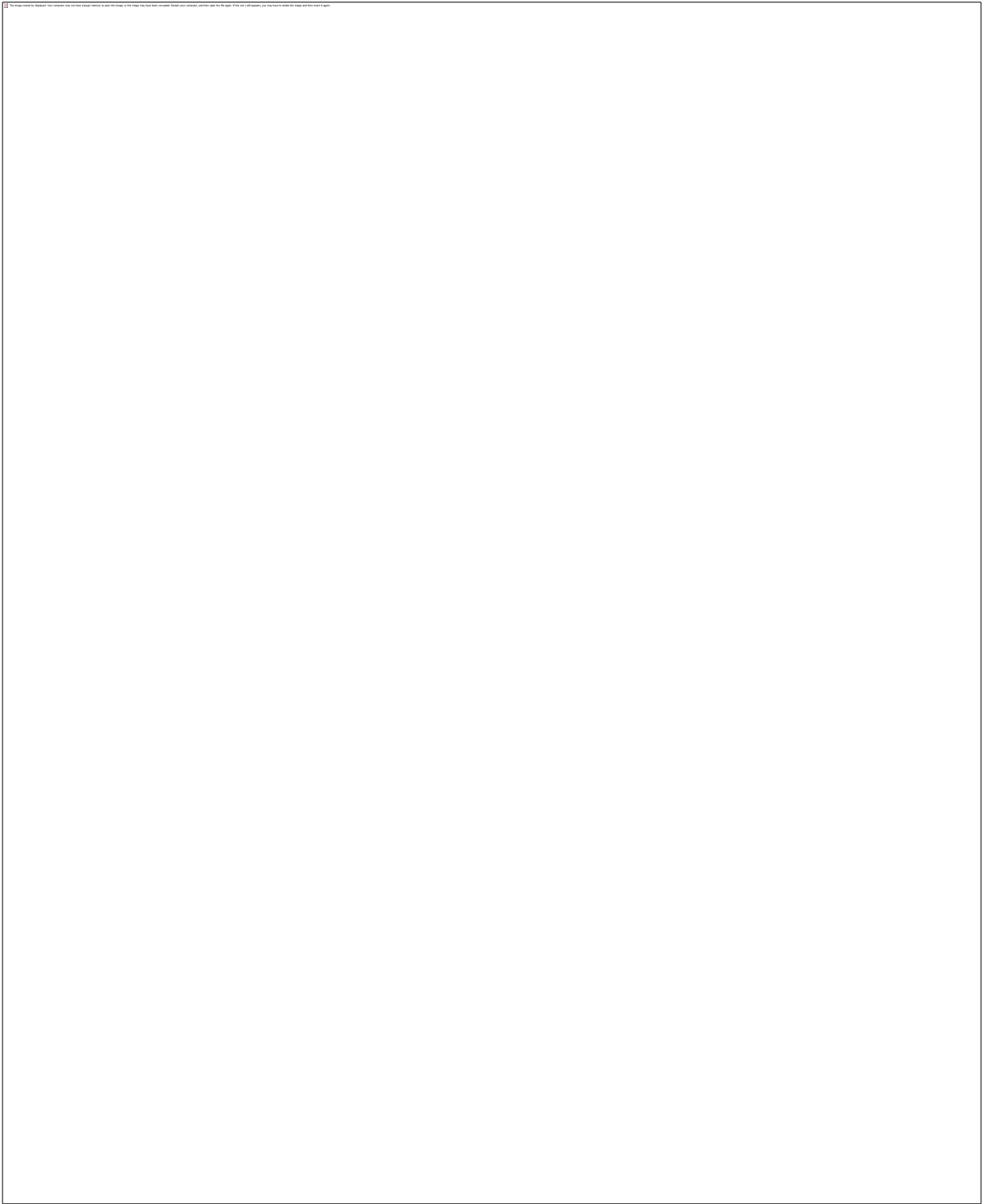
Appendix H: Correlations between main study variables for Study 2

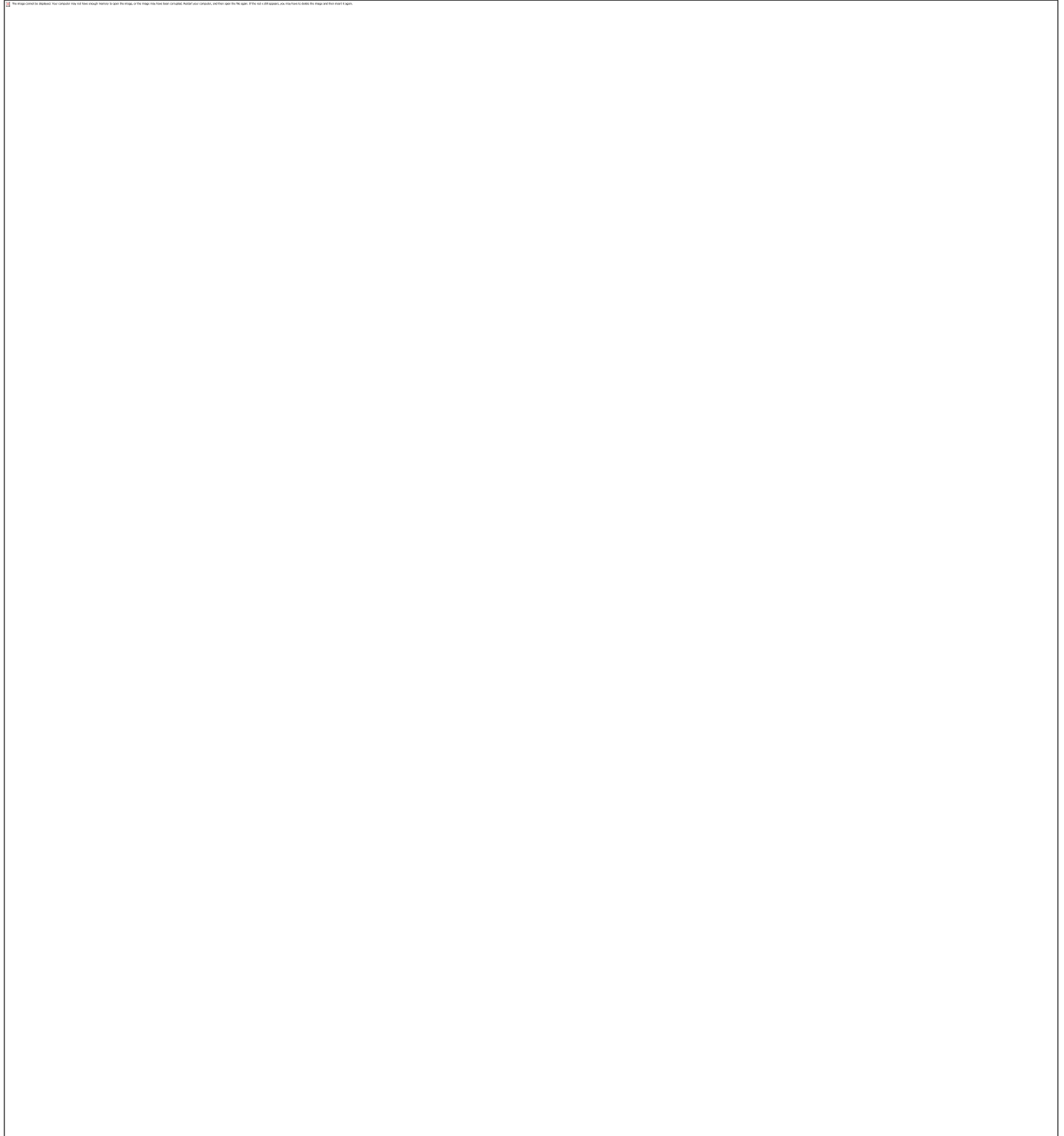
PS Effectiveness, Self-Efficacy and Anticipated Persistence relative to CR exercise, Problem-Solving, and Solution Implementation

	1	2	3	4	5	6	7
1. PS Effectiveness	-						
2. SRE for CR Exercise	.256 ⁺	-					
3. Ant Persist with CR Exercise	.232	.690**	-				
4. Self-Efficacy for PS	.627**	.363**	.264 ⁺	-			
5. Ant Persist with PS	.541**	.253 ⁺	.392**	.630**	-		
6. Self-Efficacy for SI	.456**	.249 ⁺	.143	.564**	.312*	-	
7. Ant Persist with SI	.463**	.181	.208	.401**	.308*	.691**	-

Note. ** Denotes correlation is significant at the 0.01 level (2-tailed). * Denotes correlation is significant at the 0.05 level (2-tailed). + denotes correlations between p = .055 and .08. Abbreviations: PS is problem-solving, SI is solution implementation, SRE is self-regulatory efficacy, Ant Persist is anticipated persistence

Appendix I: Ethics Approvals for Study 3





Appendix J: All Measures for Study 3

Demographic Information

What is your email address and/or phone number?

(For contact purposes only if you wish to be included in the draw-will not be linked to your responses)

What is your age? _____

What is your gender?

- ☐ Female
☐ Male

What is your current marital status?

- ☐ Married/common-law
☐ Single
☐ Widowed/Divorced

Are you currently working?

- ☐ Yes
☐ No

If yes, please indicate the option which best describes your work:

- ☐ Full-time
☐ Part-time
☐ Self-employed
☐ Casual/Temporary
☐ Unemployed
☐ Other _____

Diagnoses: Type of Cancer (Check all that apply)

- ☐ Breast ☐ Colon and Rectal ☐ Lung ☐ Prostate
☐ Leukemia ☐ Thyroid ☐ Other (Specify) _____

Date of diagnosis (Provide month and year if known): _____

Are you currently undergoing treatment?

- ☐ Yes
☐ No

Please indicate any treatment that you are currently undergoing or have undergone:

- ☐ Radiation therapy ☐ Chemotherapy ☐ Surgery ☐ Transplantation
☐ Other (Specify) _____

Please indicate which cancer-related symptoms you have experienced: (check all that apply)

<input type="checkbox"/>	Fatigue
<input type="checkbox"/>	Hair loss
<input type="checkbox"/>	Pain
<input type="checkbox"/>	Weight loss
<input type="checkbox"/>	Skin changes
<input type="checkbox"/>	Nausea/vomiting
<input type="checkbox"/>	Other _____

Do you regularly take part in physical activity?

<input type="checkbox"/>	Yes
<input type="checkbox"/>	No

Are you currently exercising at least one day per week?

<input type="checkbox"/>	Yes
<input type="checkbox"/>	No

Have you participated in exercise at least one time per week for the past four weeks?

<input type="checkbox"/>	Yes
<input type="checkbox"/>	No

For your exercise, do you:

<input type="checkbox"/>	Attend a class (i.e., fitness class 2 times per week)
<input type="checkbox"/>	Exercise on your own (i.e., go for runs)
<input type="checkbox"/>	Attend a class and do exercise on your own
<input type="checkbox"/>	Other _____

Do you feel that exercise is an important part of managing cancer-related symptoms such as fatigue?

<input type="checkbox"/>	Yes
<input type="checkbox"/>	No

Structured Group Exercise:

INSTRUCTIONS: Please think back to your participation in structured group exercise over the past month.

In the past month, on average, how many times did you attend a structured group exercise class each week?

Please select the appropriate **number of times** from the dropdown menu.

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, More than 10 times per week

Independent Exercise:

INSTRUCTIONS: Please think back to your participation in independent exercise/exercise on your own over the past month.

This may include your customized exercise program if you have been prescribed one.

How many times did you participate in **strenuous** exercise independently/on your own time for **20 minutes or more continuously**?

STRENUOUS exercise is any exercise when your heart beats rapidly. Some examples include running, jogging, swimming, aerobics class, resistance training, or any activity at about this intensity.

Please select the appropriate **number of times** from the dropdown menu.

How many times did you participate in **moderate** exercise independently/on your own time for **20 minutes or more continuously**?

MODERATE exercise is any exercise that is not exhausting. Some examples include fast walking, gentle yoga, tai chi, qigong/chi going, or any activity at about this intensity.

Please select the appropriate **number of times** from the dropdown menu.

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, More than 10 times per week

Baseline Self-Regulatory Efficacy

The following questions are about your confidence to perform certain actions related to different aspects of your exercise.

INSTRUCTIONS: Please think of your exercise participation during a typical week.

Using the scale provided, please rate your confidence for each of the following actions related to exercising *over the next 2 weeks*:

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Not at all										Extremely
Confident										Confident

Over the next 2 weeks, how confident are you that...

1. Over the next 2 weeks, how confident are you that you can arrange your weekly schedule in order to do your exercise no matter what?
2. Over the next 2 weeks, how confident are you that you will develop solutions to cope with **unexpected** barriers that can interfere with your exercise?
3. Over the next 2 weeks, how confident are you that you can make up times during the same week when you miss your exercise sessions?
4. Over the next 2 weeks, how confident are you that you will maintain your regular exercise frequency even though it may be difficult at times?
5. Over the next 2 weeks, how confident are you that you will resume your regular exercise frequency when it is interrupted and you miss exercise for a few days?
6. Over the next 2 weeks, how confident are you that you will develop plans for each exercise session to reach your desired level (i.e., intensity) of exercise?
7. Over the next 2 weeks, how confident are you that you can make a plan of action to maintain your current exercise frequency each week, **despite things that can prevent you from carrying out planned exercise**?
8. Over the next 2 weeks, how confident are you that you can prevent other things from interfering with your efforts to maintain your current exercise frequency each week?

Self-Regulatory Efficacy in the face of cancer-related fatigue

INSTRUCTIONS: The following questions are about your exercise participation when you experience fatigue that is related to cancer and its treatment. Imagine that you are experiencing cancer-related fatigue and expect that this will not change for the next 2 weeks.

Please use the scale below to rate your confidence in carrying out each of the following actions related your exercise related your exercise when you are fatigued:

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Not at all										Extremely
Confident										Confident

1. Over the next 2 weeks, how confident are you that you can arrange your weekly schedule in order to do your exercise no matter what?
2. Over the next 2 weeks, how confident are you that you will develop solutions to cope with unexpected barriers that can interfere with your exercise?
3. Over the next 2 weeks, how confident are you that you can make up times during the same week when you miss your exercise sessions?
4. Over the next 2 weeks, how confident are you that you will maintain your regular exercise frequency even though it may be difficult at times?
5. Over the next 2 weeks, how confident are you that you will resume your regular exercise frequency when it is interrupted and you miss exercise for a few days?
6. Over the next 2 weeks, how confident are you that you will develop plans for each exercise session to reach your desired level (i.e., intensity) of exercise?
7. Over the next 2 weeks, how confident are you that you can make a plan of action to maintain your current exercise frequency each week, **despite things that can prevent you from carrying out planned exercise**?
8. Over the next 2 weeks, how confident are you that you can try hard to prevent other things from interfering with your efforts to maintain your current exercise frequency each week?

Anticipated Persistence with Exercise

INSTRUCTIONS: The following questions are about your thoughts related to exercising when you experience cancer-related fatigue.

How much **time** are you willing to put forth in order to engage in exercise when you experience cancer-related fatigue?

1	2	3	4	5	6	7	8	9
Little or no time								As much time as it takes

How much **effort** you are willing to put forth in order to engage in exercise when you experience cancer-related fatigue?

1	2	3	4	5	6	7	8	9
Little or no effort								As much effort as it takes

How willing are you **to persist** with exercise when you experience cancer-related fatigue?

1	2	3	4	5	6	7	8	9
Will not persist at all							Will persist with strategies	

How much of your **attention** are you willing to direct to engage in exercise when you experience cancer-related fatigue?

1	2	3	4	5	6	7	8	9
Little to no attention toward this							Will direct complete attention toward this	

Decisional Struggle

Keeping in mind your thoughts about exercising when you are fatigued.

How much do these thoughts make you struggle with your decision to exercise when you are fatigued?

INSTRUCTIONS: Please use the following scale to answer.

1	2	3	4	5	6	7	8	9
No Struggle			Moderate Struggle			Tremendous Struggle		

Perceived Fatigue

The next section is about fatigue. Everyone has a unique experience with fatigue and a unique view about it so we will ask you about your feelings, thoughts, and general experience related to fatigue.

Please use the following scale to rate your level of fatigue during a typical week.

1	2	3	4	5	6	7	8	9	10
No fatigue					As fatigued as I could be				

INSTRUCTIONS: Please respond to the following questions to help us understand your cancer-related fatigue.

To what degree are you now feeling:

1	2	3	4	5	6	7	8	9	10
Patient								Impatient	
1	2	3	4	5	6	7	8	9	10
Relaxed								Intense	
1	2	3	4	5	6	7	8	9	10
Exhilarated								Depressed	
1	2	3	4	5	6	7	8	9	10
Able to concentrate							Unable to concentrate		
1	2	3	4	5	6	7	8	9	10
Able to remember							Unable to remember		
1	2	3	4	5	6	7	8	9	10
Able to think clearly							Unable to Think clearly		

Fatigue Acceptance

INSTRUCTIONS: Below you will find a list of statements. Please rate the truth of each statement as it applies to you. Use of the following rating scale to make your choices. For instance, if you believe a statement is “Always True,” you would write a 6 in the blank next to that statement.

0	1	2	3	4	5	6
Never	Very	Seldom	Sometimes	Often	Almost	Always
True	Rarely	True	True	True	Always	True
Very	True				True	

1. I am getting on with the business of living no matter what my level of fatigue is ____.
2. My life is going well, even though I have fatigue ____.
3. It's OK to experience fatigue ____.
4. It's not necessary for me to control my fatigue in order to handle my life well ____.
5. Although things have changed, I am living a normal life despite my fatigue ____.
6. There are many activities I do when I feel fatigue ____.
7. I lead a full life even though I have fatigue ____.
8. Controlling fatigue is less important than any other goals in my life ____.
9. Despite my fatigue, I am now sticking to a certain course in my life ____.
10. When my fatigue increases, I can still take care of my responsibilities ____.
11. It's a relief to realize that I don't have to change my fatigue to get on with my life ____.

Intrusive Rumination

During an experience with cancer, people sometimes, but not always, find themselves having thoughts about their experience even though they don't try to think about it.

INSTRUCTIONS: Indicate for the following items how often, if at all, you had the experiences described.

Please respond relative to your experience of these **during the weeks in which you have been engaged in your exercise program.**

0	1	2	3
Not at all			Often

1. I thought about cancer when I did not mean to.
2. Thoughts about cancer came to mind and I could not stop thinking about them.
3. Thoughts about cancer distracted me or kept me from being able to concentrate.
4. I could not keep images or thoughts about cancer from entering my mind.
5. Thoughts, memories, or images of cancer came to mind even when I did not want them.
6. Thoughts about cancer caused me to relive my experience.
7. Reminders of cancer brought back thoughts about my experience with cancer.
8. I found myself automatically thinking about cancer.
9. Other things kept leading me to think about my experience with cancer.
10. I tried not to think about cancer, but could not keep the thoughts from my mind.

Deliberate Rumination

During an experience with cancer, people sometimes, but not always, deliberately and intentionally spend time thinking about their experience.

INSTRUCTIONS: Indicate for the following items how often, if at all, you deliberately spent time thinking about the issues indicated.

Please respond relative to your experience of these **during the weeks in which you have been engaged in your exercise program.**

0	1	2	3
Not at all			Often

1. I thought about whether I could find meaning from my experience with cancer.
2. I thought about whether changes in my life have come from dealing with my experience with cancer.
3. I forced myself to think about my feelings about my experience with cancer.
4. I thought about whether I have learned anything as a result of my experience with cancer.
5. I thought about whether cancer has changed my beliefs about the world.
6. I thought about what cancer might mean for my future.
7. I thought about whether my relationships with others have changed following my experience with cancer.
8. I forced myself to deal with my feelings about cancer.
9. I deliberately thought about how cancer had affected me.
10. I thought about cancer and tried to understand what happened.

Psychological Well-being (Autonomy)

Please think of each of the following statements relative to your exercise participation.

INSTRUCTIONS: Use the scale below to rate your agreement with each of the following statements **relative to your exercise participation**.

	0	1	2	3	4	5	
Completely							Completely
Disagree							Agree

1. I am not afraid to voice my opinions, even when they are in opposition to the opinions of most people
2. My decisions are not usually influenced by what everyone else is doing
3. I tend to worry about what other people think of me
4. Being happy with myself is more important to me than having others approve of me
5. I tend to be influenced by people with strong opinions
6. I have confidence in my opinions, even if they are contrary to the general consensus
7. It's difficult for me to voice my own opinions on controversial matters
8. I often change my mind about decisions if my friends or family disagree
9. I judge myself by what I think is important, not by the values of what others think is important

Appendix K: Correlations between main study variables for Study 3

Exercise Social Cognitions and Fatigue-Related Variables

	0	1	2	3	4	5
Problem-Solving Effectiveness	-					
1. Perceived Fatigue (Cognitive/Mood)	-.631**	-				
2. Fatigue Acceptance (Activities Engagement)	.395*	-.515**	-			
3. Self-Regulatory Efficacy for Exercise	.355**	-.155	.420*	-		
4. Persistence	.345*	-.203	.341*	.652**	-	
5. Decisional Struggle	-.416*	.057	-.160	-.557**	-.388*	-

Note. ** Denotes correlation is significant at the 0.01 level (2-tailed). * Denotes correlation is significant at the 0.05 level (2-tailed).

Correlation Matrix of Positive Psychological Functioning Variables

	1	2	3
1. Psychological Well-Being (Autonomy)	-		
2. Deliberate Rumination	-.343*	-	
3. Intrusive Rumination	-.332*	.474**	-

Note. ** Denotes correlation is significant at the 0.01 level (2-tailed). * Denotes correlation is significant at the 0.05 level (2-tailed).